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THE PACIFIC BASIN



EXPLOSION

Smeroe, Dutch East Indies, in eruption. The explosion of pent-up forces might well be taken as a symbol for the whole Pacific area.

THE PACIFIC BASIN

A HUMAN AND ECONOMIC
GEOGRAPHY

By

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and

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FOREWORD

FOR years past writers have been prophesying that the centre of world affairs was moving from the Atlantic to the Pacific. Observers have reminded us of the dominant role that Asia has played in human history, and have declared their belief that the forces of geography and humanity were shifting the world centre of gravity back to Asia from Europe where it had rested for a few short centuries. Such statements must be treated with caution. Whilst it may be true that the massive concentrations of people in southern and eastern Asia will ultimately give these areas an importance beyond anything they have owned in the last three centuries, it would be rash to claim for them predominance in world affairs. It may be that the leadership of Europe as a continent has ended; it is certain that Europe as a system of ideas and as a way of life has not. If she is to be displaced and her suzerainty ended, her logical successor is not China or Japan but North America where, economically and politically, dynamic influences of greater power than ever the world has known are concentrated.

In the sense that the U.S.A. and the U.S.S.R. have come to conflict mainly over the future of China, the Pacific Basin has become a theatre in which a great historic trend is taking shape. The significance of that fact needs no exaggeration: that it has vital importance for every people is clear.

We now see that when Commodore Perry presented the Mikado with the choice of peaceful trade or war in 1853, the Pacific Basin came into the orbit of world politics. That act signified the intrusion of the Western peoples into the isolationism of the Orient. It was an intrusion of foreign modes and new ideas rather than an invasion of peoples. New techniques, revolutionary inventions, strange ways of

life and work, both affronted and attracted the peoples of eastern Asia. Age-old customs and feudal societies began to crumble before the aggression of the white races. At first almost diffidently, but later with irresistible might, the ideas of European industrialism began to beat upon Mongolian minds and methods. The 'treaty ports' and the trading concessions extorted from China and Japan became the foci of a most provocative invasion. Slowly at first but with gathering momentum trade and investment flowed unwelcome into these countries. Thus Europe came to the Far East.

The changes now accelerating with such force in continental Asia were no less disruptive in the island groups throughout the Pacific. Thither the whaler and the trader, the missionary and the planter had taken the demands and products of greedy, needy Europe. The primitive social systems of the natives wilted and faded. The South Seas of song and story, of fact and fable, became an idyll of sun-kissed lands and childlike peoples. The economics of the outer world settled on primitive peoples as a blight rather than a blessing. Their islands were swept into the category of strategic areas.

This unrelated world of hermit nations and island kingdoms was defenceless before the aggression and superior techniques of the European invader. The congested lands of South-East Asia and the islands of the Pacific itself—the Philippines, the East Indies, Melanesia, Micronesia, Polynesia—were sucked steadily and irretrievably into the vortex of industrial expansion. The coming of commerce and the battleship, the 'open door,' and all the methods of acquisitive imperialism, formed a provocation and a challenge that expressed itself in 'colour consciousness' and 'loss of face.' The adaptability of the Japanese, and their acceptance

of the industrial revolution as the main weapon of defence, called into being a new order. Japan was awake; and before long, as a competitor in world markets, was challenging the industries of the Atlantic countries. New pressures began to take shape for more land, for greater resources, for enlarged markets. Japanese imperialism was on the march.

Finally and inevitably came the military challenge in the form of Japan's bid for overlordship of the Pacific; and, with the conquest of Japan and the settlement which followed, a new order in the Pacific has now arrived. The national and social aspirations of native peoples in and around the Pacific have neither unity nor uniformity, but they cannot be frustrated even by the new and terrible potency of western armaments. The developments associated with war have themselves brought vast changes. Aviation has already shrunk the Pacific to less than the former time dimensions of the Mediterranean. Interruption of the supply of raw materials such as rubber and quinine has turned the attention of the industrial chemist to the manufacture of substitutes. The economic pattern of the Pacific has already been altered by these developments in transport and supply alone. And countless other changes now remain to be assimilated and co-ordinated after conquest. The New Pacific is more vital and complex, less remote but more dynamic than the old.

The problems of China's disintegration are sufficient in themselves to occupy a century of reconstruction. When Sun Yat Sen brought about the Revolution, young China began to plan for national reform and economic welfare. The Japanese invasion hurried on the unification which the European intrusion had begun. Old ideas died hard; but, in a slow and terrible fashion, the Chinese moved painfully into their struggle for independence. China's civil war is ending but the poverty of her people, the task of raising living

standards for five hundred million people will present a vaster and more difficult problem than the reconstruction of Europe. And it would seem that the means for reconstruction must come largely from other countries in the Pacific Basin.

India's position is different. India is of Asia but not of the Pacific. Her problems of reconstruction, her struggle to achieve independence and unity is similar at base, but different in evolution and political progress. For a century and a half India has been prepared for change by the greatest imperial power the world has known, the only kind of tutelage India, at that stage, could understand and follow. Now, the master has resigned; and India, like China, must find her feet in a world where new ideas threaten old castes and customs. And, opposite across the Pacific as well as across the welter of politics in the Pacific, stands that colossus of change—the American Republic—sympathetic, powerful and vitally interested in the problems of Asia and the aspirations of Asian peoples. What will be the outcome of the good changes which are shaping cannot be predicted, but it is certain that they will alter the social and political patterns not only of the Pacific but of the whole world.

So, from the Indus to the Amur, a thousand million people are also on the march to some new order. In the pattern of that system the future of the people of the Pacific, from Thailand to California, and from Alaska to New Zealand, is involved. The Eskimo and the Maori, the Tibetan mountaineer and the Hawaiian islander, the New Guinea 'fuzzy-wuzzy' and the Japanese manufacturer are being squeezed by a shrinking world into new and more intimate inter-relations, not only with themselves but with the rest of the world. We can be certain of only one thing—the vast range and speed of change, and the unwillingness of

peoples to adapt old habits to new conditions. The Atlantic Charter needs a Pacific supplement. We can only foresee that there is no greater urgency than adequate and accurate knowledge of the people of the Basin and of their homelands.

G. L. WOOD,
P. R. McBRIDE.

Authors' Note

The revision, or rather rewriting, of a book about the Pacific Basin, twice since the disruption of the economy and politics of the area by world war, presented extraordinary difficulties. It was necessary to keep always in mind the main aim of geographical interpretation in its human aspects, and to ignore as far as possible both the destruction of war and the painful adjustments as hostilities died down. The study of passing phases had to be subordinated to the examination of changes that seemed likely to endure.

The geographer, however, is in a better position than most scientists, since the physical and climatic conditions which influence life and occupations in different regions of the Basin are relatively permanent and unchanging. The work has, nevertheless, demanded close attention to an altered and altering political situation, and constant conference with industrial and political experts upon conditions in specific areas.

The work of Miss Joyce Wood in preparing the charts and graphs which appear throughout the book carries its own commendation, and the careful help of Miss M. Bayne in reading proofs must be acknowledged. Lacking space for specific mention of a legion of others who have supplied materials or assisted in discussion, we can only tender our grateful thanks.

G. L. W., P. L. McB.

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Who hath desired the Sea—the sight of salt-water unbounded?
The heave and the halt and the hurl and the crash of the comber
wind-hounded?
The sleek-barrelled swell before storm—gray, foamless, enormous and
growing?
Stark calm on the lap of the Line—or the crazy-eyed hurricane
blowing?

Who hath desired the Sea—the immense and contemptuous surges?
The shudder, the stumble, the swerve ere the star-stabbing bowsprit
emerges—
The orderly clouds of the trade and the ridged, roaring sapphire
thereunder
Unheralded cliff-lurking flaws and the head-sails' low-volleying
thunder?

KIPLING.

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PART I

THE PACIFIC ENVIRONMENT: A GENERAL SURVEY

CHAPTER I

THE PACIFIC BASIN

NONE of the world's oceans casts such a glamour of adventure over us as the Pacific, none has so stirred man's imagination, and none affords more enticing problems to the student. From the theory that this vast depression in the earth's crust was left when the semi-liquid moon was torn from the earth-mass, to the riddle of the formation of those curious islands known as atolls, is one great field for inquiry and speculation. Turning from the problems of the changing earth to those of changing human life in the Pacific, we find an even wider field awaiting investigation. Whence came those wandering peoples whose descendants are found all over the spacious archipelagoes of the Pacific? Are they but the remnants of great former civilizations? What stirring dramas of history lie behind those relics of Hindu colonization in Java and Sumatra? How came the massive monuments at Easter Island to be placed in that lonely outpost? Why was that 'Venice of the South Seas' at Ponape in the Carolines deserted? By what marvellous skill in navigation did the old Polynesian pilots lead their migrant peoples over the trackless ocean? These, and many other questions at whose answers we can but guess at present, show that in many ways we are only beginning our acquaintance with the greatest of oceans.

This vast expanse of water—wider and deeper than any other—covers an area larger than that of all the land above

sea-level; its waters extend over one-third of the whole surface of the globe. The volume of its waters is twice that of the Atlantic, and its extent is almost too vast for the mind to comprehend. From the Philippines to Panama means a

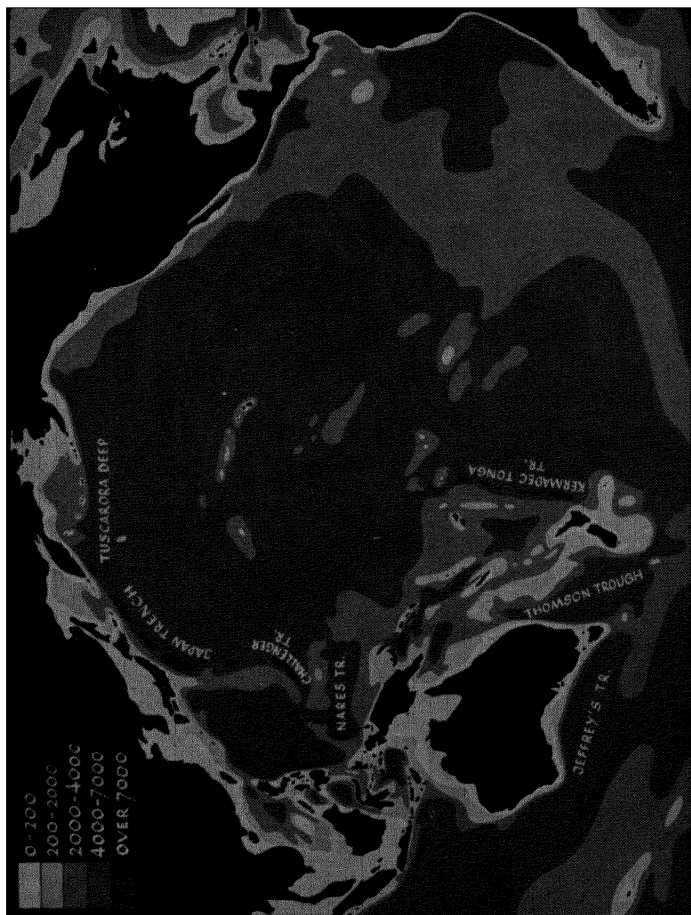


FIG. 1. The Floor of the Pacific.

voyage of ten thousand miles, and the distance from the Antarctic to Alaska is almost as far. The coasts washed by the Pacific Ocean are longer, its enclosing mountain walls higher, and its submarine valleys deeper than any others in the world. Its enormous basin holds most of the world's islands, and it is ringed about by most of the world's active volcanoes.

The land surface which drains into the Pacific is, on the other hand, comparatively small. It is but one-fourth of the size of the corresponding Atlantic area. It represents an area less than three times the size of Australia; but on it live one-third of the world's people. The eastern wall is formed by the mighty cordillera known as the Rocky Mountains in North America, and as the Andes in South America, a great series of earth folds stretching for eleven thousand miles, and sloping steeply to the ocean floor. The coast plain on this side is, consequently, extremely narrow, while the streams are, in the main, relatively small.

The divide between the Pacific and Arctic basins is broken by a narrow gap of less than 40 miles at Bering Strait; and on the Asiatic side it runs away south and west through the Stanovoi, Altai, Tian Shan, and Tibetan highlands to climb gradually to the mountain core of the Pamir, 'the roof of the world.' This great curve of mountain wall encloses the Pacific slope of eastern Siberia, Manchuria, China, Indo-China, and Malaya, with its four great valleys of the Amur, Hwang-Ho, Yang-tse, and Mekong, comprising an area as large as South America. Behind the river valleys stand the highest and most extensive plateaux on the globe; and, as a background to the fertile valleys of China, rise the mysterious highlands of Tibet and Mongolia, with the towering heights of the Himalayas and the vast ranges of the Tian Shan, the 'mountains of heaven'.

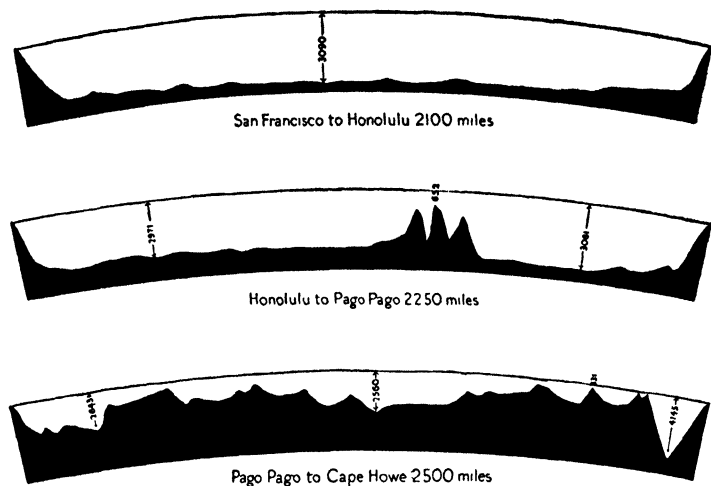


FIG. 2. Profiles of the Ocean Floor Depths in fathoms, U.S.A. Hydrographic Survey.

The mountain fold which forms the Pacific-Indian watershed now stretches south and east like a gigantic sea serpent with its undulations in places above water, as in the Sumatra-Java-Timor chain, and in places submerged as in the deeps between these islands. This chain continues through New Guinea, New Caledonia, and New Zealand to Antarctica. The upward warping of the crust millions of years ago in ancient times gave rise to the Eastern Highlands of Australia. This watershed follows the coast south to Bass Strait, where it dips, partly submerged, to reappear in the Tasmanian Plateau.

To the south the Antarctic continent lies wholly within the Antarctic Circle, and is, as yet, comparatively unknown. Here there are summits rising to 15,000 feet above sea-level, some of them, e.g., Mt. Erebus, being active volcanoes. The

heights run parallel to the shores of what is called Victoria Land, which possibly preserves under its mask of ice the characteristic coastlines of the Pacific. Here the heights are really the edge of a vast plateau rising to a level of 10,000 feet, from which the world's greatest glaciers slide slowly down towards the sea.

The line of folding reappears above water and is continued through South and North America as the Andes and Rockies which form the 'backbone' of those two continents. The Andean system is a series of parallel Alpine folds running close to the west coast at a distance of 30 to 150 miles, and it comprises the longest unbroken mountain system on the earth's surface. More than a dozen summits rise above 19,000 feet, and the peak of Aconcagua towers up 24,000 feet above sea-level. Amongst these peaks are the highest volcanic cones in existence. The crustal unrest of this region convinces some observers that the process of uplift is still incomplete. From Aconcagua the system divides into two chains to enclose the high plateau draining Lake Titicaca. Uniting again near the equator, they again diverge and lose height rapidly towards Central America.

After an interruption by the older east-west arrangement of Central America, the Divide again becomes well marked from Tehuantepec, and continues north as the Rocky Mountains, which resemble the Andes Cordillera, but are lower and wider. The Rocky system, too, is more broken by lower passes, shows less contrast between eastern and western slopes, and is also set back farther from the coast. This mountain system is a double one in its general arrangement. It comprises two systems diverging to enclose the great Salt Lake Basin which sinks in parts below sea-level. Nearer the coast, the Sierra Nevada Mountains also reach great heights, Mt. Whitney reaching nearly 15,000 feet. Converging again

towards Alaska, the cordillera becomes even higher and Mt. MacKinley (20,400 feet) is the loftiest peak.

One-fourth of Asia, one-fifth of North America, one-tenth of Australia, and one-sixteenth of South America, in all one-seventh of the world's land surface, drains into the Pacific. The steepest part of the ocean floor is found in the north-west corner, where it rises to emerge as the Japanese and Kurile Islands. To the east of this wall lies one of the deepest abysses in the earth's crust. It is part of an enormous depression situated in the north central Pacific called the Tuscarora Deep, which is everywhere deeper than 4,000 fathoms. Where the depression touches the Japanese wall it deepens to form the great gully known as the Japan Trench, which, like all the ocean trenches, is a centre of volcanic activity. Lower depths have been obtained elsewhere in the Pacific, but no other depression approaches the Tuscarora in extent. To the south the floor of the ocean is broken by a series of more or less parallel ridges with deeps lying between them. The greatest depth yet obtained was found by the German ship *Emden* in May, 1927. This was a sounding of 34,210 feet, or enough to submerge Mount Everest with over 5,000 feet to spare.

The walls of the ocean basin rise steeply and then flatten off towards the continents much like the shape of a soup-plate. The width of this flattened brim differs greatly according to the steepness of the bounding wall; but it is, in general, much wider on the Asiatic than on the American side. It includes the whole area of many shallow seas like the China Sea and the stretch between Northern Australia and New Guinea, and associates most of the great islands except Celebes and New Zealand with the nearest continent. Looked at in another way, the land bordering the coastline is in most cases a low plain which rises gradually till it

reaches 600 feet, where a more abrupt slope to greater heights commences. This coastal plain is continued under the sea, gradually dipping till it attains the depth of 100 fathoms, where it drops, more or less abruptly, to the ocean floor. This flattened rim between the shoreline and the 100 fathoms line is known to oceanographers as the *continental shelf*. The action of the waves and tides ceases to be felt at about 600 feet depth; and the immense deposits of silt brought down by the rivers, together with the deposits torn down by the action of the waves, are spread out and form this rim. Here flourish the seaweeds and the vast array of sea life which they harbour; and so the shelf becomes the feeding-ground for most of the fish that are of use to man.

Deposits of different kinds are ever accumulating in the ocean. A shower of fine silt brought down by the rivers, carried out by waves or winds, dispersed by volcanic eruptions or carried along by ocean currents, is always settling to the bottom. Along with this goes another shower of lime fragments made of the skeletons of the myriads of microscopic organisms that swarm in the ocean. The floor of the ocean is thus covered with a mantle of fine mud or *ooze*, which fills up the hollows and rounds off the roughness of the ocean bed. These deposits fall, naturally, on and near the continental shelf for the most part, and form the earth-like or *terrigenous* deposits found usually within 250 miles of the shore. Farther out, in the deep water remote from land, are the *pelagic deposits*, mostly stiff red or brown clays containing little lime. These cover more than half the bed of the Pacific. From the length of time which pelagic deposits take to form, and from the teeth and bones of extinct species of sharks and other fish which are found at these depths, it is thought that these great depressions have never been above water.

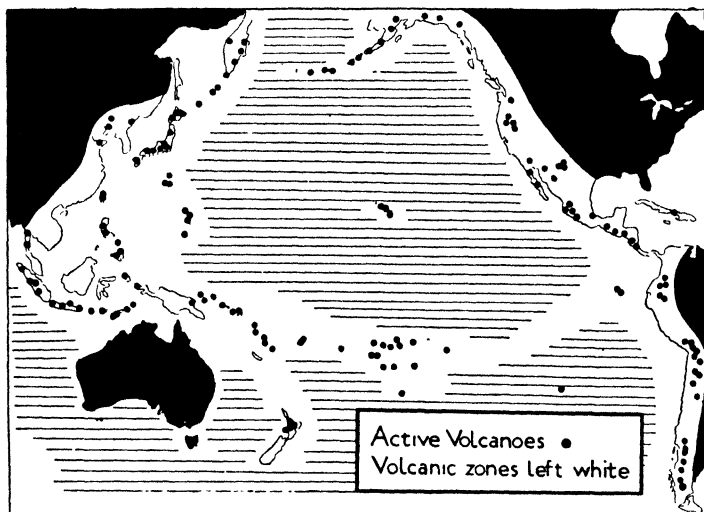


FIG. 3. Volcanic Zones of the Pacific.

The Pacific Basin has been in the past an area of great disturbance of the earth's crust. That it is still a region of unrest is indicated by the rising and sinking of certain coasts, and by the frequency of earthquakes. The reasons for this activity are still a matter of dispute among geologists; but, however the folding, subsidence, and elevation are caused, it is certain that lines of weakness are developed in the rocks of the earth's crust. These lines of weakness act as safety-valves for subterranean energy, and volcanoes are the result. Of the 415 active and extinct volcanoes known in the world, no less than 337 are found in and around the Pacific. Following this string of volcanoes around the ocean, we can trace an almost unbroken line from the North Island of New Zealand through the New Hebrides, New Guinea, the Philippines, Formosa, Japan, the Luchu Islands and Kam-

chatka. Crossing by the Aleutian chain this line continues right down the American cordillera to the Antarctic, where it ends in Mounts Erebus and Terror. A second line of weakness appears to swing off through Manchuria and to rejoin the main line by way of the Malay Peninsula, Java, and the Sunda Islands. The condition of unrest which characterises the Pacific coast is further demonstrated on the floor of the ocean in the very many groups of volcanic islands thrown up from Hawaii to Kermadec, from Fiji to the Galapagos. The continual appearance and disappearance of small islands is further evidence.



FIG. 4. NGAURUHOE IN ERUPTION, N.Z.

The volcano is always active but periodically has outbursts of greater violence. Note the symmetry of the cone.

A great contrast is presented by the coasts of the Pacific and of the Atlantic Oceans. Both east and west of the Pacific the great mountain folds have a north-south set,

with warps or bulges out towards the centre of the ocean. In the eastern Pacific the big series of folds which runs through the two American continents has been thrust up against the block forming the floor of the ocean. The great land mass of Asia, however, was so solid and heavy that the line of weakness developed more especially along the edge of the continental shelf, where an unusual form of folding took place. These partially inundated folds have formed what J. W. Gregory called *festoons* of islands. On the American side the alpine valleys of Alaska and British Columbia have been drowned and fiords with associated islands have been formed.

It will be worth while at this stage to emphasize this arc-like formation of the island chains, since this feature has been taken as the basis for dividing the islands of the Pacific into three main groups. Lying close to Australia is the first great arc stretching from New Guinea to Fiji and including the Solomons, New Caledonia and the New Hebrides. From the sooty black colour of the people who inhabited this group it was called *Melanesia*. After an interval of clear sea comes a longer arc bending from the Pelews through the Mariannes, Carolines, Marshall, and Gilbert Islands to end north of Fiji. From the small size of the islands this chain was named *Micronesia*. Then, far out in mid-ocean, from Midway Island through the medley of the Marquesas, the Tuamotus, the Friendly and Cook Islands, is a great irregular 'scatter' known as *Polynesia*.

So much has been written about 'lost Pacific continents' that the relation of these festoons or arcs to the land-masses is of some importance. Geological research and ocean soundings prove that the islands fall into two great classes. There are first the *continental islands* formed by the tops of the partially submerged ridges and plateaux already mentioned;

and, structurally, parts of an old parent continent. Others formed by volcanic and coral action and having no relation to the build of the older land-masses are called *oceanic islands*. Continental islands rise from the continental shelf or from spurs of this shelf, e.g., New Guinea; and the continental shelf of the former continent may be taken to extend eastwards from Asia and Australia to a line connecting the Marshall, Gilbert, Samoa, Fiji, and Kermadec islands through the major group of New Zealand. Along this line occur the Kermadec, Tonga, and Higgard trenches, which probably mark the outward edge of a great former land-mass of which the continental islands are the remnants.

East of this and extending to the American wall is the true Pacific depression, from the floor of which rise the relics of volcanic upheavals which form the island-strewn expanse of Polynesia. These peaks and ridges rise with comparative steepness from great depths, and many fail to reach the surface. Of those which do emerge, some, like Hawaii, are so recent as to retain their original form of lava-cones and craters; while others, like Tahiti, have been much eroded and altered in appearance. The jagged outlines and steep peaks of these islands form much of the scenic charm of island landscapes in the Pacific. Many, again, have been so reduced that they have disappeared beneath the surface altogether; and this lowering has been accompanied by the building of coral-reefs which now stand at sea-level as the characteristic *atolls* of the South Seas such as the Tuamotus and countless others, like 'garlands laid by the hand of Nature on the tombs of departed islands.'

Coral islands and reefs are mainly formed of the stony skeleton of carbonate of lime built up by organisms known as coral polyps. They take many forms, but that of most importance in reef building unites into great branches.

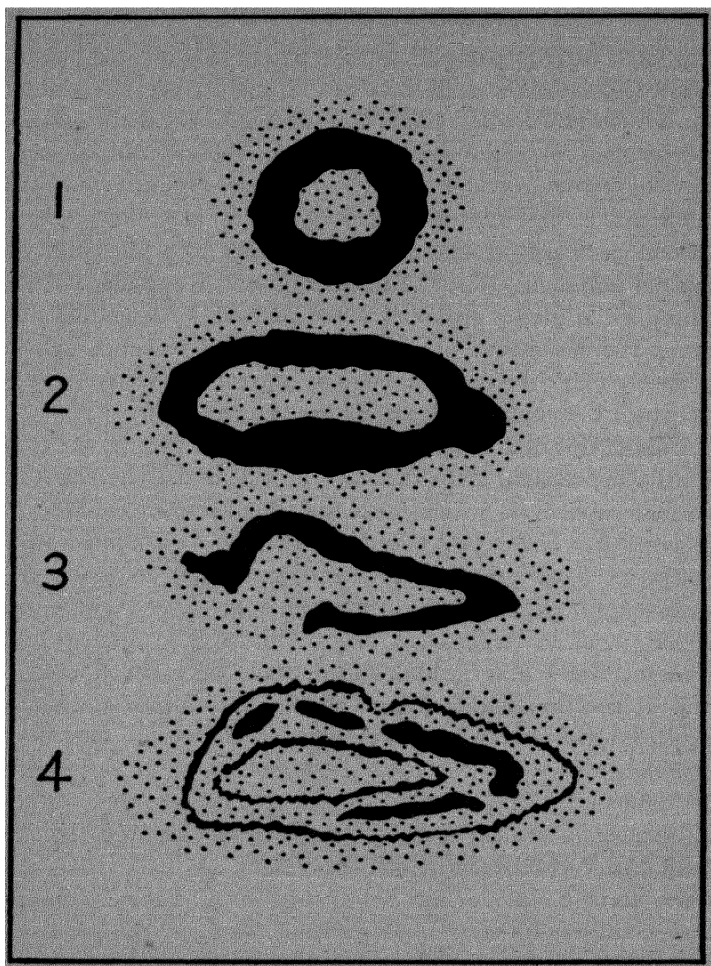


FIG. 5. ATOLLS OR LAGOON ISLANDS

Land shown black; reefs dotted.

1. The perfect atoll is shaped like a ship's lifebuoy. It enclosed a lagoon.
2. A more common shape is an irregular oval.
3. Most usually the ring of land is broken in one or more places.
4. Many atolls are a mere string of islets standing on the reef.

Although they are found in all the temperate seas, these polyps flourish best in very warm and clear salt water. If the temperature is less than 70° , or if the depth is greater than 20 fathoms, they are not active. They are, therefore, confined to the centre and west of tropical oceans, where the warm equatorial currents favour their growth.

Coral structures assume three distinct forms: (1) The *atoll*. This is a reef of a circular form with no land appearing in the centre. The water so enclosed is known as a lagoon, and is usually shallow with further coral forming the bed. The polyp cannot build above sea-level, but blocks of coral are smashed off by the waves, thrown up on the reef and ground into coral sand. By the action of the sea this is gradually cemented into a compact mass of limestone, and may rise in time to small heights above sea-level. Because they live on sea water organisms the coral polyps extend the reef by growing seawards, while those on the lagoon side die or at best remain inactive. The form is seldom quite circular, and almost never complete; only portions of the reef show above the water, and thus take on the appearance of a chain of small islands. (2) The *fringing reef*, which is found near the shore in shallow water and grows seaward, leaving a muddy flat which gradually becomes dry land. (3) The *barrier reef*, which runs parallel to the coast and at some distance from it, with great depth, usually, on its seaward side. The Great Barrier Reef of north-east Australia, which runs for 1,200 miles along that coast like a huge natural breakwater, is the best example of many reefs of this kind.

Darwin concluded that atolls originated in fringing reefs forming around a volcanic cone. As the island slowly sank, the polyps building on the skeletons of dead polyps kept the reef up to sea-level. Eventually, as the corals extended

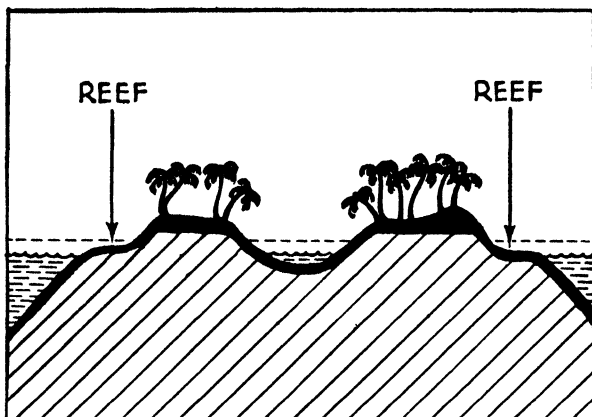


FIG. 6. SECTION OF ATOLL

Coral islands are often the unsubmerged summits of peaks rising from the ocean floor. The summit is surrounded by a rim or collar of coral reef usually a hundred yards wide or more forming a platform at about low-tide level. These are 'fringing' reefs; but sometimes they are detached from the coast and are called 'barrier' reefs.

seawards to take advantage of the better conditions in the breakers, the reef would become a barrier reef. Finally, as subsidence still continued, the original mountain disappeared below the sea and left the reef, which continued its growth to form an atoll. Sir John Murray, however, during the famous cruise of the *Challenger*, formed the opinion that the foundation for coral reefs was in every case supplied by submarine banks, which were raised by the deposit of ooze until they were within the range of coral. According to him, the corals raise a flat table of rock. When it reaches the surface it grows more rapidly on the seaward side, where food is more plentiful. The coral polyps on the inside then die, and a lagoon is gradually hollowed out by the action of

the waves, so that the atoll grows outward without widening, like a smoke-ring. The only flaw in this theory is that reefs are rare on rising coasts. Another theory of the formation of coral atolls is that of Daly. His theory is that with the fall in sea-level during the Ice Age the existing islands were worn down to a platform between low and high tide levels. With the rise of sea-level in post-glacial times, these platforms were submerged, and the coral atolls were built up on them. Perhaps it is reasonable to suppose that atolls are, in fact, formed in many ways.

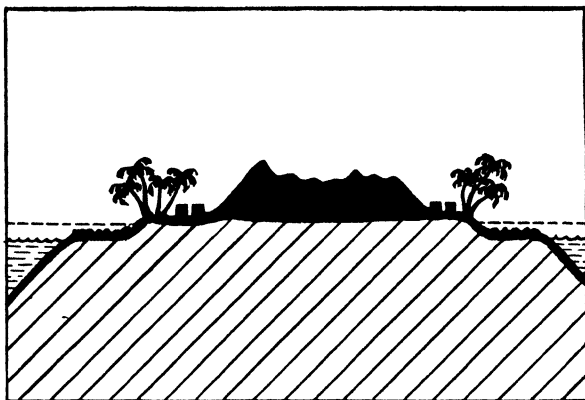


FIG. 7. ELEVATED CORAL ISLAND

It is like an atoll in formation except that the centre is a low hill instead of a lagoon. The reef or collar is typical of both the atoll and the elevated island.

The most significant features of the distribution of land on the west side of the Pacific are the prolongation of Asia eastwards so as almost to meet Alaska at Bering Strait; the arrangement of the Japanese, Kurile and Aleutian festoons; and the formation of the Malay Peninsula-Timor chain run-

ning parallel with Borneo, Celebes, Ceram, Papua, and the Melanesian festoon to form a double line of stepping stones from Asia to the South Pacific. This projection of the great land-mass of Asia away out to mid-ocean has given the Pacific a marked Asiatic character. Geologically the rocks

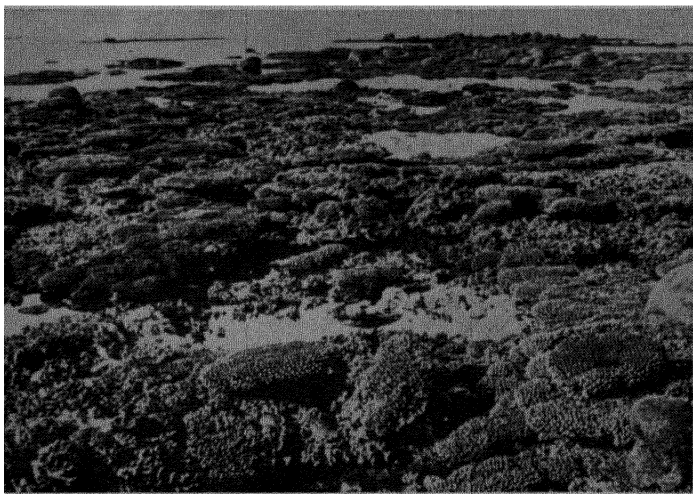


FIG. 8. THE GREAT BARRIER REEF

Built up by coral polyps into a massive structure stretching for 1,200 miles at distances from 10 to 150 miles from the north-east coast of Australia. The surface of the reef or coral platform is shown at low tide: in places it is 100 miles wide.

belong to the Asian system, whose structure and composition are retained by islands at great distances from the present continent. Again, the plants and animals are Asiatic rather than American or Australian in character. Above all, the human life is undoubtedly Asiatic in origin. The two extensions at the north-eastern and south-eastern corners of Asia offered easy routes for the migration of all forms of life. Man, with the help of frozen seas, could doubtless walk

the whole way from Asia to America; and the similarity of human types on both sides of the Pacific make it seem likely that he did so. On the other hand, migration to the south-east must have involved some navigation; and thus we have the two great modes of migration—walking and sailing—determined by the arrangement of the land-masses. But the scattered oceanic islands were a different problem. They are not arranged on any such convenient plan; and their small size and wide spacing offer no easy bridges for the migration of plants and animals. Each group stands alone, geologically and biologically, like Coleridge's Ancient Mariner:

‘Alone, alone, all, all alone,
Alone on a wide, wide sea.’

Since our chief aim is to examine the lands of the Pacific Basin as homes for man, something must be said concerning another important factor of the environment, the soil. The chemical composition of the soil, its heaviness or lightness, its depth and extent, are factors which combine with climate and topography to fix the areas suitable for agriculture, and, in the long run, determine broadly both the distribution of the population and its density. What man can do towards improving, reclaiming or irrigating soil is but a tiny part of what has already been done for him by nature. The great flood plains of the mighty rivers with their alluvial and wind-borne soils made possible the teeming valley populations of Asia. The Indo-Gangetic Valley and the basins of the Yang-tse and Hoang-Ho show on the grand scale the value of good soils to man. On the American side the fertile Sacramento and San Joaquin Valleys afford further illustration. Every variety of soil is to be found on the continents of the Pacific Basin and on the continental islands; but the oceanic islands are limited to two kinds. The weathered

remains of volcanic material yield the variably fertile soils of islands like Fiji and Java. Decomposed masses of coral from ages of reef-building have formed the second type, i.e. limestone beds of the atolls and of the island coasts.

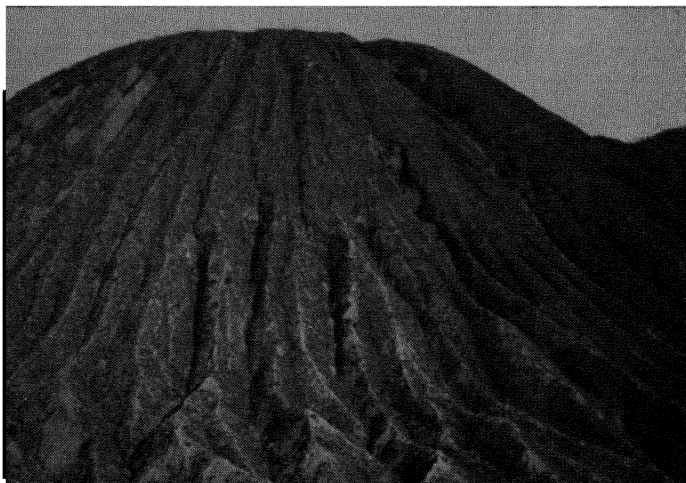


FIG. 9. THE GENESIS OF SOILS

as shown in the East Indies. The erosion by water of these ash cones is typical of the first stages of soil-making in volcanic areas.

CHAPTER II

CLIMATE IN THE PACIFIC BASIN

THE big facts of the land and water distribution in the Pacific area have now been sketched. Climate is the second great factor which helps to decide how well or how poorly man can live in any region. Climate decides where certain plants and animals can live, and thus makes possible not merely the production of those commodities like silk and wool which are derived from them, but also the exchange which is the basis of trade. It not only limits the range of crops which can be grown in any area; whether, for example, wheat or rice or taro shall constitute the main food supply; but it also influences methods of cultivation, as the contrast in the methods of growing wheat and rice well illustrates. Further, it has a very important effect on man's own comfort and energy, making him sluggish in the hot humid weather, and brisk and energetic in the cool. In this way his efficiency and his social and economic progress are affected.

We must not, however, lay too much stress upon the effects of climate, since, unlike the plants and animals which can adapt themselves only very slowly to changes in their surroundings, man has been able to move about and to select his habitat. Thus by his ability to roam he can escape the full tyranny of climate; but only under very great stress, such as a shortage of food continued for a long time, will those mass movements which we call migrations take place. In whatever climate he is found, man tends to 'stay put.' He has the greatest objection to changing his home and the particular climate, country, foods, and habits to which he has become accustomed. Slowly, silently, persistently. long residence in any region will affect the temperament of the

inhabitants, their energy, and their ability to resist disease. For better or for worse, these changes are continuous and almost imperceptible. The hardy and industrious Chinese, the malaria-riddled Indian, the fun-loving Polynesian are all what they are partly because of the climate of their homelands.

In short, it is not too much to say that climate, in addition to its powerful influence over the food man eats, the clothes he wears, and the shelter he requires, also decides to some extent the level of his civilization. His standard of living helps to determine the character of his culture. Every study of Pacific peoples will furnish illustrations of these facts. The Maoris of New Zealand, migrating from their warmer home in mythical 'Hawaiki,' had to adapt themselves to colder conditions which called for greater effort. In the struggle they developed their mental and physical powers, invented tools, built houses, and wove clothing suited to the new environment, developed an elaborate social system, and raised their status among the peoples of the world to a high level. The history of the Japanese, the achievements of the Eskimo in the Arctic regions, the adaptation of Europeans to the 'new' countries of the Pacific, and the struggle of the primitive Australian aboriginal against the arid conditions of his homeland furnish other instances of the influence of climate on man.

The most important aspects of climate in this connection can best be studied by considering separately the chief factors influencing weather, such as heat and cold, the effects of altitude, the all-important air pressure and circulation, and the consequent wetness or dryness of different regions. On these will depend the control which climate will exercise on human life and progress. Owing to the moderating influences of great masses of water, and the comparative

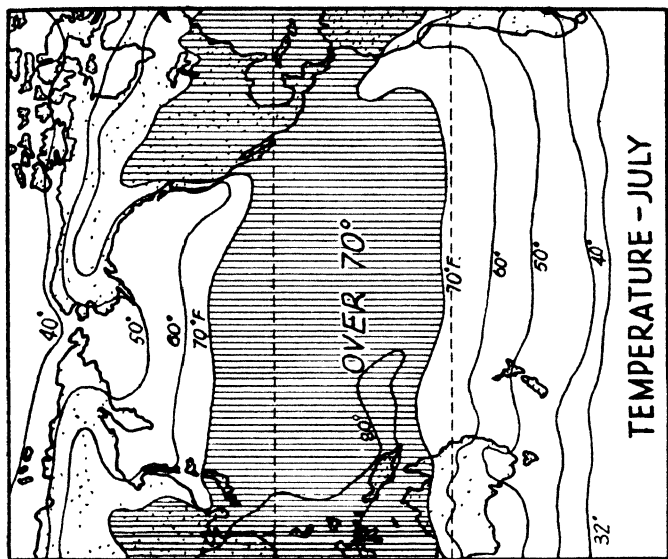
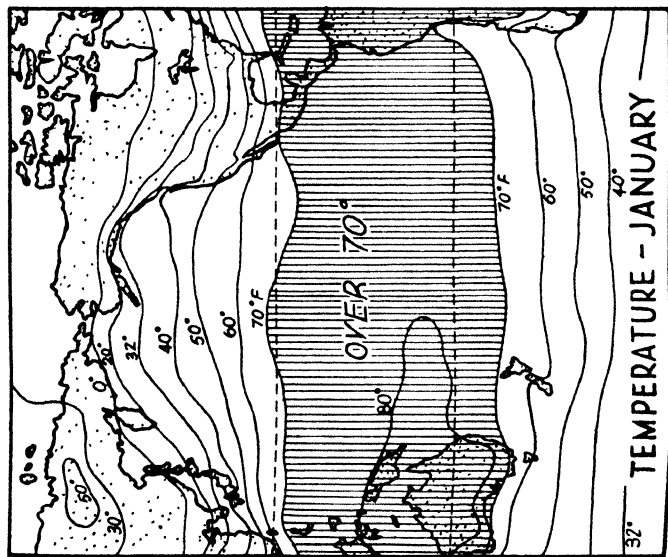
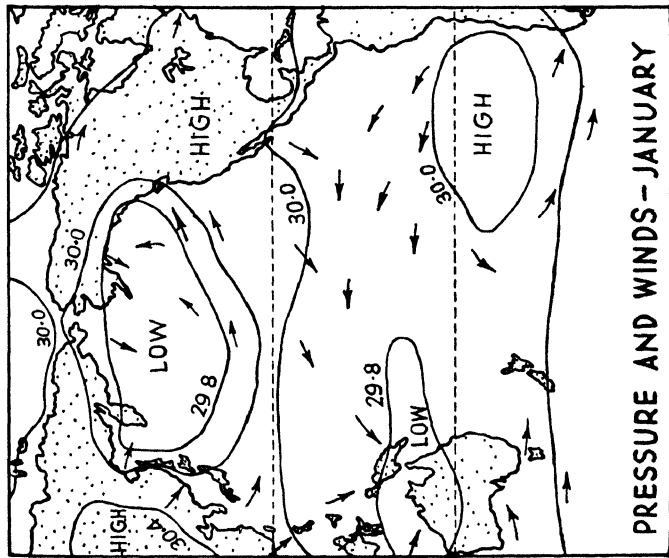


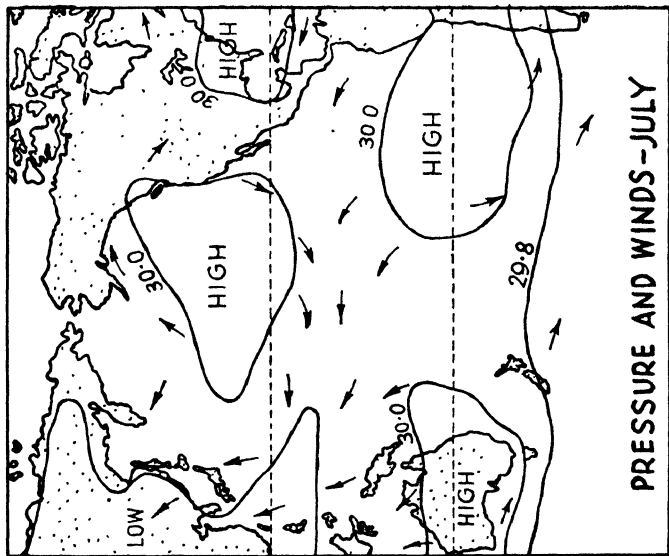
FIG. 10. Temperatures—Average temperatures for the months of January and July.

evenness of surface within the basin itself, atmospheric conditions in the Pacific are remarkable for their close conformity with the world system. A description of this system will serve to make a study of the climates of the Pacific Basin clearer.

If the surface of the earth were quite uniform, and the sun always shone overhead along the equator, the line of greatest heat and the equator would coincide. There would be constant low pressure in a zone along the line of greatest heat, and constant high pressure immediately north and south. Subject to deflection by the rotary movement of the earth, air would flow regularly from the constant 'high' to the constant 'low' pressure area. Actually the annual march of the sun north and south of the equator causes the line of greatest heat to move north and south too; but not so far nor so uniformly. The whole system of pressure belts swings with the line of greatest heat, the extent of the swing varying because of many local conditions, such as the proportion of land and water, and the proportion and arrangement of high land. Likewise, the wind belts associated with these pressure systems move north and south with the sun, but in an irregular fashion. As a consequence, however, of the great uniformity of the ocean surface, climatic conditions in the south and central Pacific tend to be very regular. The steadiness of the Trade and Westerly winds in this area is remarkable. West of the Pacific the swing of the wind systems is exaggerated by the closeness of the two great land-masses of Asia and Australia, with the line of greatest heat swinging between them. The North-east Trades are pulled further south in January and the following months, and become the rain-bearing monsoons for northern Australia, and dry off-shore winds for Asia. Six months later the South-east Trades have been pulled far to the north by the



PRESSURE AND WINDS - JANUARY



PRESSURE AND WINDS - JULY

FIG. 11. Pressure and Winds—Average pressure for the months of January and July and prevailing winds.

great indraught over southern Asia, and constitute for that continent the southern monsoons, which are dry off-shore winds for Australia.

The normal Trades are brisk breezes blowing steadily most of the time at 10 to 15 miles an hour. The blue sea and crisp white-capped waves are characteristic. These winds modify the enervation usual in these latitudes, and account mainly for the pleasant climate of the so-called 'South Seas.' The Westerlies, on the other hand, are by no means so regular nor so moderate. They constitute a drift of the air-body to the east. In this current more or less violent eddies develop, and are carried along as the rain-bearing 'lows' which are so characteristic of the climate of countries coming under the influence of the westerly drift. The Westerlies are steady and strong enough in the southern hemisphere to have earned the name of the 'brave west winds'; but the gales that accompany the 'lows' have given the latitude of greatest frequency the sinister title of the 'Roaring Forties.'

The most remarkable result of this 'one-way traffic' in wind circulation is the one-sided rainfall effect where the Trades or Westerlies cross land high enough to cause heavy discharge of their moisture. Thus most of the islands of the Pacific, e.g., Fiji, Hawaii, Tasmania, have a wet windward side and drier leeward side. On a bigger scale continents are likewise affected. The coast of Queensland, for example, receives ample rainfall from the trade-winds which leave the corresponding coast of Western Australia as absorbers rather than depositors of moisture.

Conditions in the North Pacific are not nearly so regular; and climate for places in the same latitude varies greatly. The east-coast regions of continents in the northern hemisphere have, in general, more extreme climates than the west-coast regions. Hardy cereals such as barley and rye can

be cultivated only in certain protected valleys in Sakhalin, while in British Columbia in the same latitude all the temperate grains and fruits are grown as commercial crops. The main Japanese islands are in the same latitude as California, but have a far more rigorous climate. Coasts and islands, too, have generally a much smaller range of temperature than continental interiors. The remarkably uniform temperatures of Melanesia, Micronesia, and Polynesia are a commonplace of meteorology. Mean annual temperature here varies little above 70° Fahrenheit, and there is no appreciable difference between the temperatures of the warmest and coldest months. The range from midday to midnight temperature is greater than the range from summer to winter. The following table will show typical differences in the range of temperature for maritime and interior situations.

TEMPERATURES FOR JANUARY AND JULY IN °F.

<i>Coastal</i>				<i>Inland</i>			
<i>Place</i>	<i>Lat.</i>	<i>Jan.</i>	<i>July</i>	<i>Place</i>	<i>Lat.</i>	<i>Jan.</i>	<i>July</i>
Sydney	33·5°S	72	53	Bourke	30·5°S	83	53
Shanghai	31·2°N	40	82	Chungking	29·3°N	48	84
Vancouver	49·1°N	36	63	Winnipeg	49·6°N	—3	67
Lima	12·2°S	73	61	Asuncion	25·2°S	82	66
Honolulu	21·3°N	71	78	Chicago	41·6°N	26	74

These figures suggest the difficulty involved in any attempt to classify climate. Modern meteorology has gone a long way from the old and rather primitive division into tropical, temperate, and polar; and it is now realized that there are very different types of tropical climate, and that the so-called temperate climates show the widest extremes.

With regard to temperature we can distinguish four main belts which provide a useful grouping for economic purposes. The basis of this division relates to the number of months of the year during which man can carry on agriculture, i.e. the number of months during which crops will grow.

1. *Hot Lands*: hot all the year round with an average temperature for each month of more than 65° F. Growth is never stopped because of cold.

2. *Warm Temperate Lands*: average temperature of the coldest month between 27° and 65°—a short dormant season due to low temperatures. Most deciduous trees require at least eight months with average temperatures about 50° F. Crops like wheat can mature in less time.

3. *Cool Temperate Lands*: average temperature of the coldest month is below 27° F., but the average temperature of the warmest month is above 50° F.; a long dormant winter with a short hot summer. The summer temperatures are high enough for the growth of coniferous forests.

4. *Cold Lands*: average temperature of the warmest month does not exceed 50° F. so that trees cannot grow. Where the average temperature rises above 32° F. for one or more months the typical tundra vegetation, bushes, mosses and lichen, is found. In the colder regions where the average temperature for any month seldom rises above freezing point, there is no vegetation.

It should be remembered, however, that human comfort depends on humidity as much as on temperature, and that the mere record of heat is not enough to determine whether a region is habitable. Further, the effect of the amount and distribution of rainfall in limiting vegetation growth within these temperature zones must be borne in mind. Still, in so far as these four belts indicate the zones that are favourable

or otherwise for vegetation growth, the classification is a useful basis on which the natural regions of the world, including the Pacific, can be broadly determined.

The climates of the various regions of the Pacific basin will be discussed in detail in the chapters on natural regions. At present, we can notice the influence of certain general factors only.

1. *The influence of distance from the sea*

The modifying influence of the sea upon temperature has already been mentioned. In this connection we can distinguish three main climatic types:

i. *Oceanic climate*. This is marked by moderate temperatures, high humidity, heavy rainfall and much wind. There is a relatively small variation between summer and winter, and between day and night temperatures, in fact, so small in some islands that the stimulus of weather changes is lacking.

ii. *Continental climate* is different from oceanic climate in every respect. Instead of a range of less than 10° F. between the mean of the hottest and coldest months, the range may be three or four times as great. In the interior, the range may be from a minimum somewhere below zero to 70° F.

iii. *Coastal climates*, as the name implies, are a transition type between oceanic and continental, and the farther from the seaboard the less is the oceanic effect felt. Mountain ranges along the coast in fact often confine the coastal type to a mere coastal ribbon. Wind direction and the 'grain' of the country, therefore, determine how far inland the marine influence is felt. Where the prevailing winds are mostly on-shore, as on the west coasts of continents in the westerly wind belt, the climate is markedly oceanic; but

where the prevailing winds are off-shore as on the east coast of Asia in winter, or in north-west Australia, the temperature conditions of the interior are carried right to the shore-line.

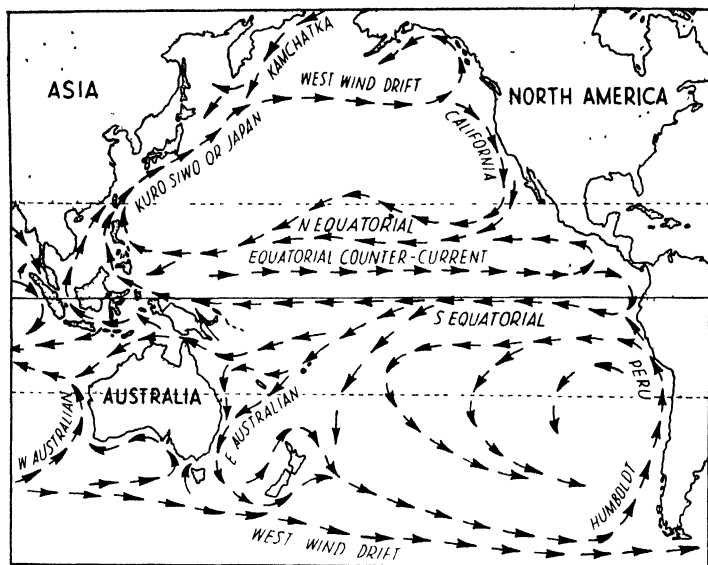


FIG. 12. The Surface Currents of the Pacific Ocean.

2, *The influence of topography*

i. *The fall in temperature with increase in altitude.* Plateau or mountain climate is the result of altitude rather than of latitude since the decline in mean temperatures with increasing elevation is most marked. Cool temperatures and low moisture content of the air are characteristic.

ii. *Effect of topography on rainfall.* The direction of the mountains in relation to the prevailing winds has a very important effect on rainfall distribution. Where on-shore

moist winds are forced up by a mountain barrier as the westerlies are by the Rockies in Canada, and the south-east trade-winds are by the eastern highlands of Australia, they precipitate their moisture on the windward slope, giving it a heavy rainfall, while the lee side remains comparatively dry.

3. *The influence of ocean currents*

Where the winds blow on-shore, they carry the temperature effects of the ocean currents running along the coast with them. The surface currents are largely determined by the wind system, and the general effect may be likened to the spinning of a wheel. To start the wheel spinning one pushes the rim in the direction of spin; and the spin could be helped by pushing one way on the top side and in the opposite direction on the bottom side. A similar circulation is given to the waters by the trade-winds and the westerlies which stir the surface water in opposite directions. Thus in the South Pacific, the trades blowing off-shore from Peru push the cool surface waters nearer the equator. This stream sweeps past the Galapagos Islands as the commencement of the South Equatorial Current. Pushed to the west by the steady trades and becoming warmer all the time, it sends off branches among the many island groups and passes on down the Australian coast as the East Australian Current. It then sets westward under the influence of the westerly winds until it unites with the smaller branches in a drift towards South America, becoming steadily cooler. This drift splits on the wedge of Cape Horn, one current passing up the west coast as the cold Humboldt Current to join the South Equatorial Current again.

Off the coast of California, the north-east trades set up a similar current which sweeps west as the North Equatorial Current, and turns round by way of Japan as

the Kuro Siwo, or Japan Current, to be pushed towards the North American coast by the westerlies. The behaviour of the currents near the East Indies is so important that they must be studied a little more closely. Off the coast of New Guinea the South Equatorial Current divides and streams round through the Malay Archipelago to join the North Equatorial drift* to the north of the Philippines. During the period of the south-west monsoon, a tributary current sets in from the Indian Ocean, and increases the volume so much that the broad, warm stream with a surface temperature of 85° F. carries its moderating influences right along the Chinese and Japanese coasts. This current is to the Pacific what the Gulf Stream is to the Atlantic. The warm water of the two Equatorial Currents is piled up around and between the East Indies, and one way of escape is along the belt of the Doldrums, between the two trade-wind currents. This drift flows straight back towards Panama as the Equatorial Counter-Current. Mention must be made also of the cold current which streams down from the Bering Sea and the Sea of Okhotsk, carrying cold temperatures as far south as northern Japan.

It has been calculated that the sea carries nearly half of the heat absorbed in the tropics away into higher latitudes to act as a warming influence along the eastern margins of continents, while the colder currents drawn down from the Polar regions extend the cold conditions towards the equator. Thus the Pacific acts as a regulator of temperature for all the shores which are washed by its currents. Its vast uninterrupted surface permits the very regular development of the air and water systems, and tends to prevent climatic extremes.

CHAPTER III

MAN IN THE PACIFIC

THE ancient Greeks saw their homeland surrounded by *Oceanus*, the great river which was the source of all streams and waters. The Father of All, dwelling far out on the edge of the world, presided over this stream, and over the lives and destinies of all that lived in and around it. In such fancy they expressed their dependence upon the sea, and acknowledged its great influence on their lives and habits. From their narrow valleys and rocky hill-sides they faced outwards over the waters which promised a more ample livelihood than their sterile homeland. The ebb and flow of the tides and the ceaseless unrest of the waters stirred the curiosity of 'the land-born barbarians about the unseen destination of these marching waters.' The islands set in the near distance beckoned the first voyagers, the warm blue seas invited to adventure, and so the Greeks by force of circumstance became at once traders, sailors, and colonisers.

Wherever man has responded to the call of the sea, it has moulded his life and outlook in much the same way, has given much the same direction to his activities, has set him the same problems of navigation and prompted the same responses of boat and oar and sail in their solution. His voyages, as they became longer and surer, brought him to new and different lands where novel conditions called forth new powers and abilities. Mastery of the sea is thus a very late chapter in the story of man's conquest of his world. For centuries he must have paused baffled at the edge of the ocean; but the long and difficult struggle gave him, in the end, command of those vast expanses of water which cover three-fourths of the earth.

With that achievement the world really became one, and the long epic of man's oversea wanderings began. Phoenician, Greek, Roman, Viking, and Arab on their voyages of trade, discovery, or piracy helped to establish those connections between the coast-dwellers which have become the great network of sailing routes in our day. The changes from the primitive raft to the mighty liner mark the painful steps by which man achieved his mastery of the sea, and, incidentally, the unity of his world. The ocean thus became the great common possession of all peoples. The emphasis that has been placed by all trading nations on the 'freedom of the seas,' and the enormous expense undertaken by modern powers to guard their trade routes, are sufficient proof of the value of right-of-way on the high seas.

Outside Europe and the adjacent areas the greatest skill in navigation was attained by the island folk west of the Pacific. Long before the date of the Norman Conquest the Malay in his catamaran had achieved long voyages that make the Odyssey seem but an incident. Here in the vast island-studded stretches of Oceania the Greek epic was repeated on a greater scale, and a race of boatmen developed who were as much at home on their warm tropic seas as on their reef-circled islands. Inhabiting a mere half-million square miles of island homelands, they pushed their dominion out over twenty-five million square miles of desolate waters. Kupé, the greatest of Polynesian navigators, selected his little band of Argonauts, and feeling his way before the trade winds, charted the islands of New Zealand, and returned to 'Hawaiki' to give his sailing directions to the great fleet of Maori 'Pilgrim Fathers.' This is a story which yields nothing in skill or endurance to those of Columbus or Drake.

Migration or invasion by sea makes up much of the history of Pacific peoples. The palm beach made a fairly

safe frontier from every enemy but the hurricane, and in these secluded areas were planted the little Polynesian colonies. But the dynamic centre of this great ripple of humanity spreading over the Pacific is to be found away back towards Asia, and for reasons which we can only



FIG. 13. MALAY FISHING BOATS, BORNEO

Populating the Pacific islands became possible when Asia produced its own Vikings.

surmise. The Indonesian Archipelago had everything needed for building a race of seamen. Here the curious mixture of river and sea bred the amphibious Malays who emphasize their love of the water by their pile dwellings. Here each settlement became another Venice; and many, like that great sea-kept city, became centres for traffic and commerce to which in after-years the European trader found his way. Along the coasts and on the rivers of Asia we find the teeming human life spilling out on to the waters because these offer food to the fisher, roads to the trader, and

highways to the adventurer. Dr. Ellen Semple, in *The Influence of Geographic Environment* has told this story of the human conquest of ocean spaces in greater detail. Many of the ideas and several of the quotations in this chapter should be regarded as a tribute to her great work.



FIG. 14. POLYNESIANS

Well-built, athletic people, they are lovers of the sea and the sun.

'Fisheries have ever been the nurseries of the seamen'; and in tempting man to dare its dangers the sea has given him experience far more valuable than any wealth it has yielded. As the sea became a highway for the peoples of the western Pacific, so islands became points of settlement and, later, jumping-off places for still further migrations, or busy ports of call along well-known trade routes. But the diffi-

culties involved in such travel were enough to daunt the bravest. East from the Philippines or the New Hebrides our Polynesian navigator would find landing-places separated by distances varying from 100 to 1,000 miles. Yet these distances were traversed, and voyages such as that from Hawaii to Samoa were undertaken over unknown seas and in open canoes—achievements beside which our great feats by sea, land, and air seem rather less wonderful.

Nor were their troubles over when the voyage was safely accomplished and the new land found. The farther the Polynesian pioneers pushed out from the continents the smaller grew the islands, and the poorer the animal and plant life. Food of a sort was obtainable; but the only plentiful article of diet was fish. Animal life they could not import, but the rice from Asia and the coco-nut, taro, bread-fruit, and yams from Malaysia were introduced and cultivated. Even flints for weapons and cutting tools were wanting, and substitutes had to be found in bones and sharks' teeth. Where, as in the case of the Maoris, the everlasting summer of the sub-tropics was exchanged for the colder, wetter climate of New Zealand wholly new arts had to be invented. Spinning and weaving were developed for warmer clothing, stone weapons were manufactured, sturdier houses built, and different plants cultivated. Indeed, the whole Pacific area supplies examples of the manner in which man has adapted himself to new homelands, or modified the conditions of a new land to make life possible. *

The migration and settlement of Pacific peoples are but one side of the story. Too often the environment proved too strong. The enervating climate, the confined space, and the easy life on Pacific islands have in many cases arrested the development of these wonderful seafarers. Civilization rose and fell in the Pacific as elsewhere. Scattered through this

island world huge monuments and abandoned colonies are all that remain of native peoples who had advanced very far in the arts of civilization. And with the coming of white men and their diseases to these regions the decadence of many Pacific islanders seems to have been hastened. Isolation can bring its dangers as well as its security. Depopulation is a distressing reality in most of the islands despite the fact that labour for tropical agriculture is so urgently required, and Asiatics have had to be imported in large numbers. The future development of the islands will demand much labour, but here are the facts about declining populations. In 1870 it was estimated that Polynesia contained 690,000 native people. In 1930 there were about 200,000, but 145,000 Asiatics and 37,000 whites had come in. Melanesia was computed to have three million natives but these recently numbered scarcely one million. Micronesia declined from 270,000 to less than 90,000. In fifty years two-thirds of the native population has disappeared.

On the contrary some of the East Indies, the Philippines, and Japan show great increases of people, so great indeed that some islands now have all the population that their resources will support. Some island peoples are already spilling over into neighbouring lands. The present century has seen a remarkable expansion in the population of Japan, comparable to that which occurred in England during the nineteenth century. This was one of the main dynamics behind Japan's attempt to expand her territory by conquest.

One other aspect of the population of Pacific regions should be noticed here. Many lands face more ways than one, and their people reflect this outlook. The wild Malayan on the mountainous east of Formosa, for example, is as different as possible from the Chinese farmer of the western plains. The Philippines hold very different peoples in the

north and the south. Again, many islands such as Borneo and Hokkaido show primitive aboriginal races in the inaccessible interior and later comers of a higher type round the coasts. These differences are a natural result of successive waves of migration washing against the same island. The later wave of migrants drives the earlier one before it. The unequal density of people all round the Pacific is another aspect of population that should not be overlooked. Densely peopled islands like Java exist alongside thinly peopled islands; China with 430 millions of people overlooks Australia with less than eight millions and so on. These crowded and empty lands, side by side, present difficult problems of development and defence, and raise many delicate questions of administration and ownership.

CHAPTER IV

THE NATURAL REGIONS OF THE PACIFIC

THE position, relief, climate, and natural vegetation of large portions of the earth's surface are so much alike that we can distinguish typical regions on the basis of these likenesses. Further, we can detect broad resemblances in man's occupations in such regions. These groups of similar areas are called by geographers *major natural regions*; and it is more useful to study the Pacific Basin by natural regions rather than the political divisions we call countries.

The factors which make up a homeland, such as build, climate, soils, and water distribution, vary so greatly that the resemblances just mentioned lie deep rather than on the surface. Furthermore, the appearance and habits of peoples living in the same natural region have often nothing in

Note: During the reading of this chapter reference to the map of climatic regions inside the back cover is essential.

common. The differences, however, will on closer study serve to emphasize the likenesses, and will help to show the effect of other than geographical factors. Only by study of this kind can man's own efforts to modify his homeland be understood. The racial stock from which the people spring, the sort of government they have developed, the past history of the region, its accessibility, and the conditions for transport form the background upon which must be shown the picture of life in different lands.

The main types of natural region illustrated by the lands in and around the Pacific Basin conform fairly closely with the classification given on p. 26: 1. Hot Lands. 2. Warm Temperate Lands. 3. Cool Temperate Lands. 4. Cold Lands. The basis of this classification of 'natural' regions is therefore climatic.

1. *The Hot Lands*

The hot lands of the Pacific fall into five main types, which are called the Equatorial, Mid-Pacific, Savannah, Monsoon, and Trade Wind Desert types. The statistics of temperature and rainfall will reveal the basis of this division more clearly than many words.

The general circulation of the atmosphere in these latitudes should be well understood. Along the belt of greatest heat, near the equator, there is a constant updraught of air which cools as it rises, until eventually condensation takes place. This air then flows out in the upper levels towards the 'horse latitudes' 30° - 35° north and south, where, owing to complex conditions the upper air becomes colder and heavier and sinks, giving the high pressure areas known as the Sub-tropical Highs. From these highs air moves out either towards the Poles as the westerlies or back along the earth's surface towards the equator as the north-east and south-east trade winds.

1. CLIMATIC DATA FOR THE HOT LANDS

<i>Natural Region</i>	<i>Place</i>	<i>Height Above Sea (feet)</i>	<i>Temperature Degrees F.</i>		<i>Mean Annual Rainfall (inches)</i>	<i>Season of Rain</i>
			<i>Jan.</i>	<i>July</i>		
1 A. Equatorial	Batavia Singapore	26	79	79	72	All seasons
		8	80	81	95	All seasons
1.B. Mid-Pacific	Ocean Is.	85	82	82	81	All seasons
	Honolulu	13	71	78	28	All seasons
	Suva (Fiji)	44	80	74	112	All seasons
1.C. Savannah	Quixeramobim (Brazil)	679	84	80	25	Mainly in summer
	Daly Waters (Australia)	700	85	67	28	Mainly in summer
1.D. Monsoon	Darwin	97	83	85	59	Mainly in summer
	Bangkok	14	79	84	52	
1.E. Trade-wind Desert	Iquique (Chile)	30	70	60	0.5	Scanty at all seasons
	Onslow (W.A.)	14	86	65	9	

1 A. *Equatorial Regions*

These regions lie in the belt of greatest heat. The cooling at some height of the continuous updraught of air gives rain almost every day. This combination of heat and wetness produces the characteristic heavy forest. From the coastal swamps to the heights inland there is, however, a great variety of climate, and of vegetation. The lowlands are those regions of damp, steamy heat so favourable to plant life, jungle pests and malarial fever, and so difficult for white settlement. Jungle warfare has focussed attention upon the difficulties of these areas for white people.

The Pacific regions belonging to this group are the Malay Peninsula, the Philippine Islands, and, that part of the archipelago embracing Indonesia, New Guinea and Melanesia.

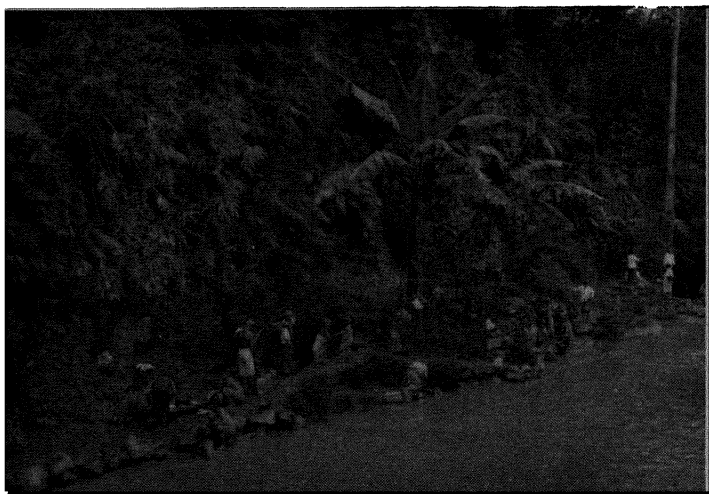


FIG. 15. WASHING-DAY IN THE JUNGLE

The vegetation riots to the water's edge, but every village has its river margin which is kept clear for laundry and bathing purposes.

1 B. *Mid-Pacific Regions*

This group comprises most of Polynesia. Typical areas are Hawaii, Tahiti, the Marquesas, Cook Islands and Fiji. The climate of this Mid-Pacific type is determined by the insular situation at great distances from any continent, in the first place, and by the action of the trade winds in the second. It is the true oceanic climate. Mean monthly temperature varies little from season to season, and rainfall increases with height above sea-level. Most islands have a wet and a dry side, and this condition controls agriculture to a great extent. Some islands are sufficiently high to trap a constant rainfall, but many, the atolls in particular, are so low-lying that they receive less rain and receive it less regularly. Some islands

surrounded by cold ocean currents receive very little rainfall. The rainfall map of Oahu (Fig. 108), one of the islands of Hawaii, will provide a good sample of the climatic conditions on the larger islands.

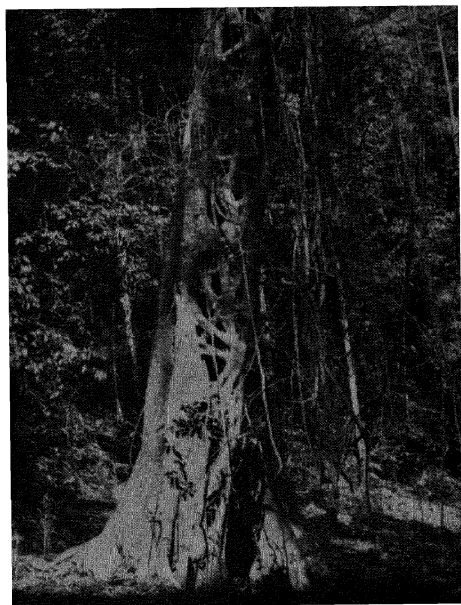


FIG. 16. WAR IN THE JUNGLE

A parasite (balete) gets in its deadly work on a jungle giant. A forest scene on Bataan Peninsula, Philippines, which 'says plenty.'

1 C. *Savannah Regions*

The most extensive Savannah regions occur around the Congo and Amazon basins. In the Pacific, they are found in inland northern Australia, in Central America, and in

coastal Ecuador and Colombia. During the hot season, these regions receive heavy rain, and experience humidities similar to those which prevail throughout the year in the equatorial region. For the remainder of the year, they are under the

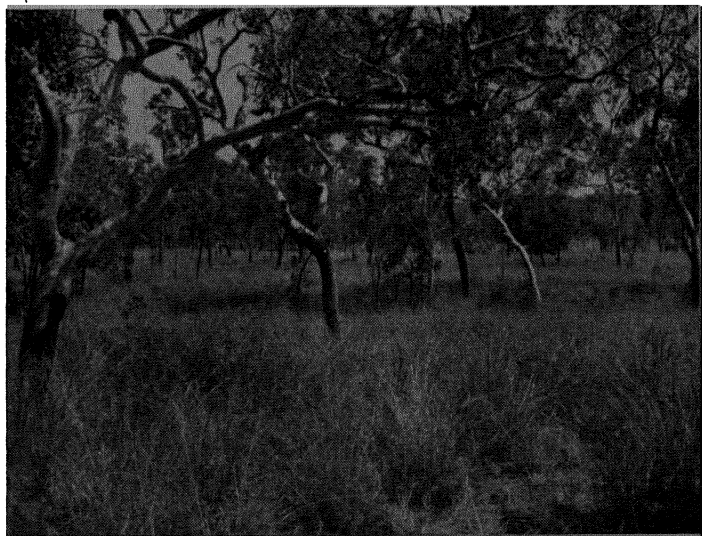


FIG. 17. THE AUSTRALIAN SAVANNAH

Hot grasslands with scattered small trees. Rainfall is about 30 inches, occurring in the hot-season.

influence of the trade winds, and this season is generally dry. Thus in contrast to the equatorial region, there are in this type two marked seasons—one hot and wet, the other warm and dry.

As we leave the equator, rainfall gets lighter by degrees until a zone is reached where there is not sufficient moisture retained in the sub-soil at all seasons to support forests. Therefore, vegetation shades off from dense tropical jungle,

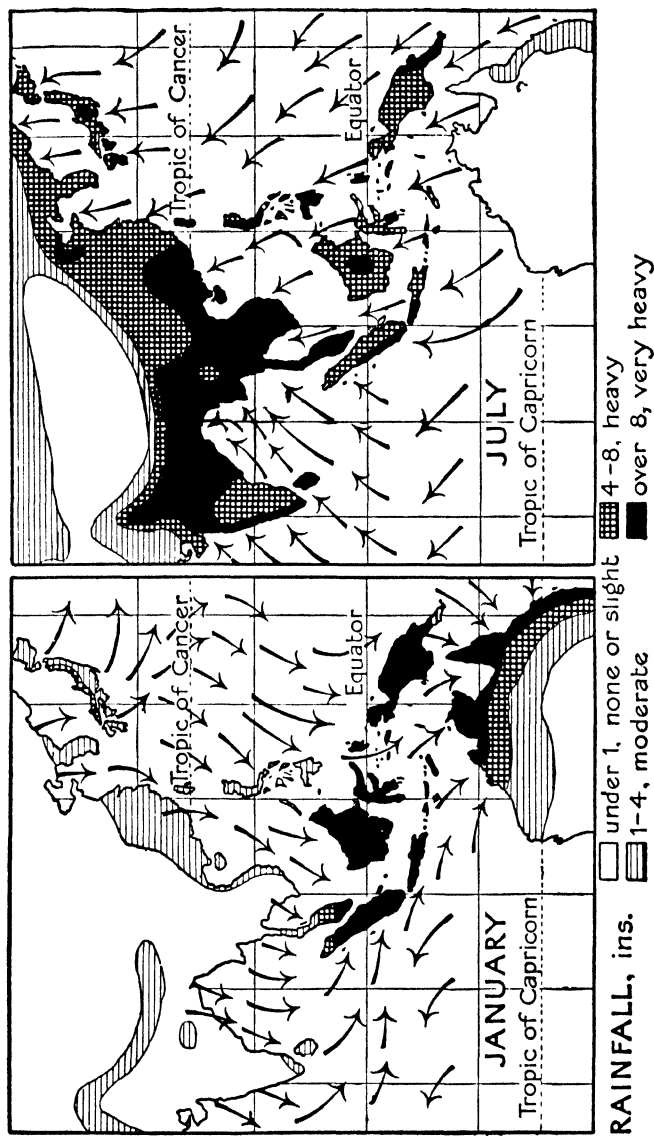


FIG. 18. LANDS OF THE MONSOONS
Winds and Rainfall—South-eastern Asia and Northern Australia.

at irregular intervals. These regions of great unreliability of rainfall are situated near the tropics, and in the zones where the trade-winds commence as dry currents rapidly



FIG. 20. THE AUSTRALIAN DESERT
'Gibber Plains' of wind-polished rock fragments merge into
sand ridges.

absorbing surface moisture. On the eastern sides of continents these winds bring rainfall, but on the west they are off-shore drying winds. Thus the Great Australian Desert, the Atacama Desert of Chile and Peru, the Desert of California, and the Bad Lands of Arizona are members of this group.

No other region is so uniform in its characteristics as the trade-wind desert. Varying greatly in extent on account of local conditions such as the arrangement of the mountains or the extent of the continental mass, they are everywhere

sterile and almost devoid of plant life. Man makes a home in these regions only under the attraction of profit as in the case of the nitrate industry of South America or the gold-fields of Western Australia. Along their margins some tribes such as the nomadic Aruntas of Central Australia or the Hopi Indians of New Mexico find a precarious existence. Civilized men have been able to found settlements at spots favoured by the presence of artesian water. The saying that 'Europe stops at the Sahara' merely emphasizes the fact that deserts have always been most effective barriers to trade and migration. The Central Australian Desert cuts off northern Australia from the south in much the same way.

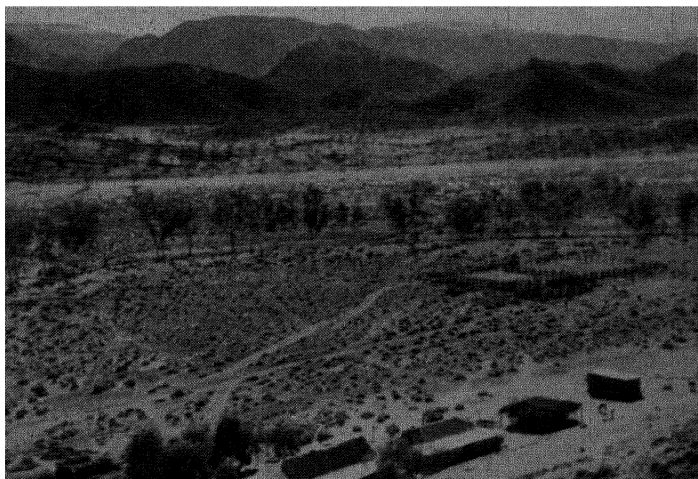


FIG. 21. SOUTH OF THE SAVANNAHS
The 'near-desert' areas of Central Australia.

CHAPTER V

THE NATURAL REGIONS OF THE PACIFIC

2. The Warm Temperate Lands

THE temperate zones are found, roughly, between the tropics and parallels 50° ; but, on account of the width of the zone and the great variety of surface, the term 'temperate' is a misnomer. There are within this belt very considerable variations in the amount of heat received during the year, and a wide range of annual rainfall. As in the trade-wind belt, east coasts of continents contrast with west coasts, and the climate of interior lowlands with that of interior highlands. It is easier, therefore, to study this great zone in two divisions, viz., warm temperate and cool temperate lands.

2. CLIMATIC DATA FOR WARM TEMPERATE LANDS

<i>Region</i>	<i>Name</i>	<i>Height Above Sea (feet)</i>	<i>Temperature Degrees F.</i>		<i>Mean Annual Rainfall (inches)</i>	<i>Season of Rain</i>
			<i>Jan.</i>	<i>July</i>		
2A West Coast or Mediterranean Type	Valparaiso	135	63	53	50	Mainly in winter
	Perth (W. Aus.)	197	74	55	35	
	San Francisco	207	50	59	20	
2B East Coast or China Type	Sydney	138	72	53	47	All seasons
	Hankow	118	40	85	48	All seasons
2C Interior or Darling Basin Type	Bourke (N.S.W.)	361	83	53	14	Most rain in summer
	San Antonio (Texas)	701	53	84	27	

The warm temperate regions are really a zone of transition from the Sub-tropical High Pressure areas to the areas of the Sub-polar Lows. They come under the influence of the Sub-tropical Highs and the Trades in summer, and the Sub-polar Lows and Westerlies in winter.

2 A. *West Coast or Mediterranean Regions*

This group forms one of the most clearly marked of the natural regions. Placed as they are, mainly on the west of continents, on the poleward side of the trade-wind deserts, these regions receive rain in winter from the westerlies, but summer is a season of drought since the rain-bearing winds have moved away. Thus the main feature of the climate is a marked winter maximum in the rainfall.

The influence of climate upon vegetation, too, is most clearly marked in these regions, since the plant life must be adapted to withstand the summer drought with its relatively high evaporation. Evergreen trees with deep-striking roots such as the eucalypts or the 'live-oaks' of California are typical, and similar trees from the Mediterranean countries have been introduced with great success.

Among these are the olives, the cork-oaks, and the citrus fruits which are cultivated in all these lands. The grape and such soft fruit trees as the peach, which need sustained warmth to bring them to perfection, find in these regions their best climate; and, where irrigation makes possible regular supplies of water during the growing and ripening period, they respond with prolific crops.

In these warm temperate lands the pastoral industry is important almost everywhere. Sheep, especially the breed known broadly as the merino, are well adapted to rainfall conditions of 10 to 30 inches a year, and have become the basis of wool and meat production as in Australia and

New Zealand, N. Island. For vast tracts of desert margin in Australia sheep raising is the only possible form of land utilization. In the wetter areas, or where irrigation is possible, dairying or cattle raising for meat become natural activities.

This is also the natural climate for wheat cultivation, because the dry, hot summers favour rapid ripening of this crop. The main industries of these regions are, therefore, concerned with sheep-raising, fruit-growing, wine-making, oil-pressing, fruit-drying and canning, and flour-milling. These are characteristic of southern Australia, the North Island of New Zealand, California, southern Peru and northern Chile. Here again the value of regional studies for indicating the crops best suited to certain regions has been amply demonstrated by the experiments in interchanging the plants of different countries. The introduction of all the fruits mentioned into Australia, and the planting of Australian eucalypts in California and Italy, are instances of assisted plant migration. In these areas the European settler has found conditions which suit him and his domestic animals admirably, and it is not surprising that these lands are all lands of white colonization.

2 B. East Coast or China Type Regions

Members of this group within or near the Pacific Basin are China and coastal New South Wales. New South Wales is affected in summer by the south-east trade-wind circulation, and in winter by the 'lows,' which carry rain from the south and bring snow to the highlands. China, especially away from the coast, is more continental in type with colder winters and hotter summers. In winter, the outflowing winds from the interior bring very low temperatures. There is no really dry season, but the greater part of the rain usually

falls in summer. This produces abundant vegetation, and a wide range of cultivation becomes possible, including such typical plants as tea, maize, and rice.

2 C. *Darling Basin Type Region*

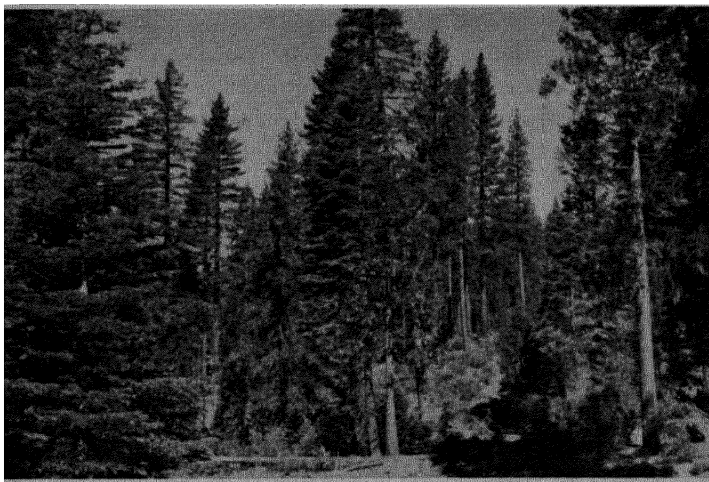
This is an interior type found in the Murray-Darling Basin of Australia, and also in North and South America on the 'high plains' eastward of the Andes and Rockies. Inland situation, characteristic climatic extremes as between summer maximum and winter minimum temperatures, and deficient rainfall mark these areas. Owing to the low-pressure generated over continents in the hot season, inflowing winds will tend to be moist, while the winter high-pressure results in dry outflowing winds. Therefore most of the rain which falls in these areas is concentrated in the summer. In general, it is only sufficient to maintain grass or poor, scrubby vegetation. The fact is that these regions are 'rain-shadow' areas, since the presence of mountain barriers in the path of inflowing winds accounts for the scanty rainfall. The vegetation is that of the 'steppe' lands, which are typical sheep-raising areas. Under modern methods of dry-farming the better-watered margins are being sown with wheat, as in the Mallee districts of Victoria and in similar areas of the Argentine. In favoured parts, the use of irrigation enables more intensive farming and the growing of grapes and citrus fruits.

CHAPTER VI

THE NATURAL REGIONS OF THE PACIFIC

3. *The Cool Temperate Lands*

THESE lands occur on the poleward side of the warm temperate regions, and come well under the influence of the westerlies throughout the year. The greater part of Europe—the home of the white race—belongs to this group. Great differences in the extent and arrangement of the cool



PLUMAS NATIONAL FOREST

FIG. 22. Mixed Conifer Stand: North-West U.S.A.
Blairsdien Unit Timber Sale, Residual stand mixed conifers.

temperate lands arise from the position of the mountain systems in relation to the westerlies. The European arrangement, highlands running for the most part east and west, allows the warm westerlies to penetrate far inland, whereas in the similar American areas the north-south set of the highlands is no protection against the cold arctic conditions.

The course of the 32° isotherm for the winter months shows how greatly these differences in the "grain" of countries affect climatic conditions.

In general the same sub-classes may be distinguished as in the case of the warm temperate lands, i.e. west and east coast, and interior.

3. CLIMATIC DATA FOR COOL TEMPERATE LANDS

<i>Natural Region</i>	<i>Place</i>	<i>Height Above Sea (feet)</i>	<i>Temperature Degrees F.</i>		<i>Mean Annual Rainfall (inches)</i>	<i>Season of Rain</i>
			<i>Jan.</i>	<i>July</i>		
3A West Coast Type	Vancouver	136	36	63	59	All seasons
	Valdivia (Chile)	30	62	46	105	All seasons
	Queenstown (Tas.)	177	62	46	99	All seasons
	Dunedin (N.Z.)	300	58	42	37	All seasons
3B East Coast Type	Vladivostock	55	7	65	17	All seasons but mainly in summer
	Hakodate	13	26	66	45	
3C Cool Temperate Type	Yeniseisk (Siberia)	279	-9	67	17	Mainly in summer
	Winnipeg	760	-3	67	20	

3 A. West Coast Regions

The climate and situation of lands of this type in the Pacific are remarkably similar. Coastal highlands set athwart the track of the westerlies occur in Tasmania, the South Island of New Zealand, British Columbia, and southern Chile. In each case the westerlies encounter high land after traversing the widest ocean expanses in the world. The distinction between the rainfall on windward and leeward sides of the intercepting highlands is common to all. The westerlies carry ocean temperatures on-shore, giving an equable climate and a fairly even distribution of rainfall throughout the year.

These regions also present great likenesses in their vegetation; and the occurrence of the typical rain-forests gives them a peculiar economic importance. The Douglas fir of

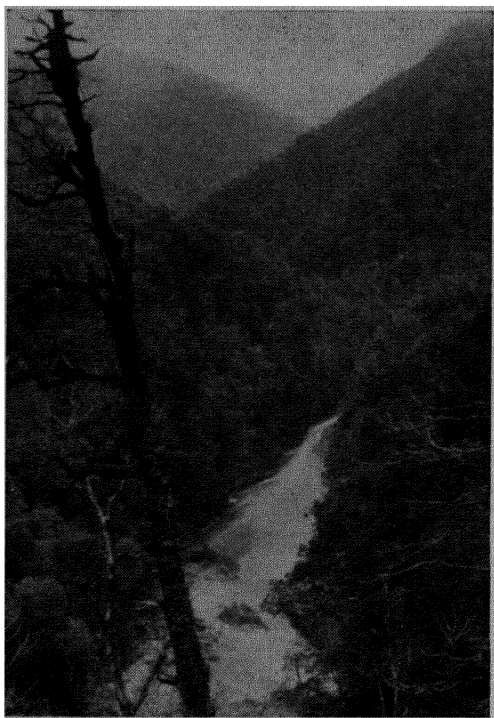


FIG. 23. RAIN FOREST

The wet west coast of Tasmania: a view
of the King River Gorge.

the Oregon and the British Columbian coastal areas is a striking product of the rainfall conditions, as are the beech forests of the west coast of Tasmania and New Zealand. The natural forests in suitable areas have been largely replaced

by introduced trees such as the apple and pear, although in the warmer and more sheltered valleys hops and fruits of the plum and apricot type are also grown extensively. The climate is well suited to dairy-farming, which tends to become the main pastoral occupation.

Typical alpine scenery, with glaciers and snow peaks, is characteristic of these areas, while fiords and drowned valleys of the *ria* type are coast features. The fiord coasts again are the results of extensive subsidence, and the conjunction of the numerous inlets and the continental shelf provide the best living conditions for many varieties of fish. This is the physical basis of great fishing industries of which the salmon industry of British Columbia and Alaska is the best instance.

3 B. *Cool Temperate East Coast Regions*

The members of this group are Manchuria and the neighbouring regions of Siberia, Sakhalin, and Hokkaido. Although these lands are in about the same latitude, they offer a great contrast to the westerly wind regions. The Pacific coast of Asia north of 50° has a more extreme and much less genial climate than the corresponding coast on the American side. The average rainfall and the distribution throughout the year differ considerably on the east and west coasts. The flow of air is predominantly off-shore on eastern coasts in this latitude, and this is the chief reason for the lighter rainfall.

Winter conditions, in particular, afford a great contrast. The Asiatic coast north of Korea is ice-bound for several months, but the harbours of British Columbia are clear all the year round. This difference is mainly accounted for by the influence of the warm currents of the north Pacific. The westerlies carry the influence of the warm ocean current to the shores of British Columbia and the American states of

Washington and Oregon; while, on the east coast of Asia, the effect of the cold winds from the interior is enhanced by the cold Kurile current which flows along the coast from the north.

The vegetation is mainly deciduous forest with conifers prevalent in the colder parts. In Manchuria, cultivation of such cool temperate crops as the soya bean, certain varieties of millet and sorghum, wheat and maize has been successful.

3 C. Cool Temperate Interior Regions

Regions of this type are found at their best in the interior of the great northern land-masses. The climate is characterized by extremely low winter temperatures contrasted with short summers, hot enough for the ripening of grains. Rainfall diminishes away from the coast, and occurs mainly in summer. The fall is not heavy enough for tree growth, hence the prairie grasslands which have become, in Canada, the famous wheat-growing areas. In Siberia, too, these lands are being developed for wheat production.

CHAPTER VII

THE NATURAL REGIONS OF THE PACIFIC

4. *The Cold Lands*

THESE inhospitable regions are nevertheless not so cold and so barren that man cannot manage to exist here and there, and as there are certain resources which tempt even civilized man to live in them, they deserve brief mention. Perhaps, too, it is only fair to say that these lands make up in interest what they lack in economic importance. Three types are to be distinguished, only one of which, the polar ice-cap, is to be found in the southern hemisphere. Stretching across Asia and North America to the north of the cool lands is a great belt of pine forest. The Soviet Government has given special attention to these areas; and, with the provision of better housing and transport, improved production is expected. Nearer the pole the forest fades out owing to the intense cold, and gives place to the open, barren lands called *tundra*. Around the poles are the regions of

4. CLIMATIC DATA FOR COLD LANDS

<i>Natural Region</i>	<i>Place</i>	<i>Height Above Sea (feet)</i>	<i>Temperature Degrees F.</i>		<i>Mean Annual Rainfall (inches)</i>	<i>Season of Rain</i>
			<i>Jan.</i>	<i>July</i>		
4A Northern Forest	Fort Chipewyan Okhotsk	714 20	-13 -11	59 54	13 11	Mainly in summer
4B Tundra	Barrow (Alaska)	13	-17	40	4	Mainly in summer
4C Ice-cap		No month above 32°F.				

perpetual ice and snow which, even though inaccurately, we call the *polar ice-caps*. The climatic data for these areas cannot convey any idea of the intense cold, or of the miraculous change that the short, nightless summer works in these Arctic lands. The contrast between the frozen sea around the North Pole and the ice-bound continent around the South Pole is also to be noted.

4 A. *Northern Forest Regions*

Forests cannot exist where the summer temperature falls below 50° F., even where the rainfall is sufficient. The dividing line, therefore, between tundra and forest is determined by the summer temperature. These northern forests are vast expanses of pine and spruce woods as yet almost untouched. They are bound to assume great importance as the world's demand for wood-pulp and cellulose grows. The structure of the trees with their needle-like leaves is admirably adapted to the long winter with its intense cold and heavy snowfall. The only tree which sheds its leaves and manages to resist the rigorous conditions is the birch. In Alaska and the MacKenzie basin the forest is found 300 miles within the Arctic Circle, but in eastern Canada it does not reach within 500 miles of this Circle, affording yet another illustration of the different conditions that are found on the western and eastern sides of continents. These forests form the world's greatest fur-hunting grounds, and are inhabited only on their fringes by such hunters and trappers as the Ostyaks and Samoyedes.

Backed by modern science, the white settler is beginning to invade even this area; and on the southern edges of the forest, especially in Canada, is steadily pushing his agricultural holdings farther and farther north. The efforts of the agricultural scientist in these areas are directed to the breed-

ing of varieties of wheat which will ripen in the short, intense summers with their long days. A period approaching 90 days for the growing season is necessary for successful wheat growing. Rye, barley, and oats are better suited as crops for this region. Considerable interest attaches to Russian experiments in crossing rye and wheat and in breeding a perennial wheat suited to the hot grasslands.

4 B. *Tundra Regions*

This is the zone of dwarfed and sparse vegetation into which the forest fades away on the north, and which in its turn gives place to the unbroken fields of snow and ice around the pole. Here all agriculture is impossible, and only in the summer is nomadic man active in these regions by reason of the movements of animals.

5. *The Highland Regions*

There are considerable local variations in climate due to differences in elevation. Near the equator, on plateaux such as those of Ecuador and Colombia, the heat is tempered by altitude, and the highlands are far more attractive to whites than the muggy malarial lowlands. Here, instead of the tropical crops of the lowlands, the inhabitants graze sheep and cattle and cultivate temperate crops.

The interior of the Pacific coast of North and South America is extremely high. In North America the Great Plains and Rocky Mountain Plateaux are, in the main, above 3,000 feet. These are areas of deficient rainfall, being far removed from the sea on the east and sheltered from the Westerlies. Arid tracts are common, and the grassland provides pasturage for sheep and cattle. The snow water from the heights has been utilized for irrigation in favoured valleys. On the Bolivian Plateau, rainfall is also

deficient and the people are mainly pastoralists. Like the Rocky Mountain Plateau, this region is well supplied with minerals, but the difficulties of transport and labour have retarded the exploitation of these resources.

On the map (see inside back cover) the regions marked as highland are those in which altitude is so great as to become the dominant control of the climate. Included in this category are the Rocky and Andean Mountain chains, the Himalayas and the plateau of Tibet. The Rockies and the Andes have certain features in common. The eastern side is, generally, drier and less forested. However, since these highlands stretch through many degrees of latitude and vary greatly in their surface and aspect, they also present great differences in animal and plant life. Further, both regions have a great and varied mineral wealth. The Rockies, in particular, offer many possibilities for future development. The fur-bearing animals of the north have always attracted a scanty population of hunters and trappers, but the immense timber, water-power and mineral resources now offer infinitely more to an industrialized world. In the valleys and on the foothills the introduction of schemes for water supply is now making agriculture and grazing on an extended scale possible.

The Tibetan tableland, situated in the centre of the world's greatest land mass, has long and very severe winters and a warm to hot summer. The conditions do not favour agriculture; and consequently, except in the warmer and more favoured valleys, pastoral pursuits are the main support of the people. As in Bolivia, the animals are associated with the conditions of their homeland—in Tibet the yak, in Bolivia the llama. As in Bolivia, there is abundant wealth but the difficulties of labour and transport handicap development.

THE NATURAL REGIONS OF THE PACIFIC 61
CLIMATIC DATA FOR HIGHLAND REGIONS

Place	Latitude	Longitude	Height Above Sea (feet)	Temperature Degrees F.		Mean Annual Rainfall (inches)	Season of Rain
				Jan.	July		
Quito	0°	78°W	9,350	57	57	42	All year
Simla	31°N	77°E	7,232	41	65	63	Mainly in summer
Salt Lake City	40°N	112°W	4,366	30	77	16	Mainly in summer
Irkutsk	52°N	104°E	1,532	-6	64	15	Mainly in winter

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PART II

MALAYA AND THE EAST INDIES

INTRODUCTION

EAST MEETS WEST

THERE could be no more appropriate introduction to the problems of the Pacific than the approach through Malaysia and Indonesia. What the Pillars of Hercules were to the Mediterranean, the Straits of Malacca became to the Pacific. The very arrangement of the islands seems to be designed to lead the adventurer into the Pacific through this gateway. Singapore stands, as Raffles rightly sensed, like some guardian of the gate, some less forbidding Gibraltar of the Orient; and is in every sense the front door of the Pacific. It was the door through which Europe entered the Pacific in search of riches—the doorway that Columbus sought but was denied. It was inevitable that Singapore should in time become the great strategic point of the Far East. The Strait of Magellan, the cold and tempestuous passage round Cape Horn to the empty backwaters of the south-east Pacific, could never be the proper gateway to this wide, warm world. It could never stir European minds to the expectation aroused by the mere titles of faraway lands—the East Indies, the Far East, the vague, vicious, glamorous South Seas. Bombay, Calcutta, Mandalay, Bangkok, Singapore—the very names sound like a fanfare heralding a great adventure.

It is not mere fantasy. Round the corner from India into the Pacific everything changes. The character of the region; the climate and weather; the people and their customs; the religions and philosophies. East meets but rejects the West.

Here are clustered the treasure islands of fact. Beyond, on the one hand, the old, tired, teeming civilization of China, and far out on the other the primitive island kingdoms. And remote, dynamic, the centre to which these island festoons and protected waterways seem to lead, the enigma of the whole great region, the hard core of Mongolian resistance to the Occident, was Japan. There is the real drama of geography set on a stage broad and colourful beyond compare.

It was Europe's misfortune that the first contacts with the Pacific peoples should be through the provocative approaches of commerce. The forcible entry of the merchant adventurers, the organized arrogance of the British and Dutch East India Companies, the rivalries of Spanish, Portuguese, Dutch, French and English throughout the region, the whole prelude to imperialism, was unlucky even if inevitable. Raffles, Brooke and a score of others—Dutch, French and English—realized to the full the worth and dangers of the Archipelago; and here, surely, was room and to spare for colonization and enlightened administration.

The merchants of the eighteenth and nineteenth centuries had all the faults of the Spanish conquistadores. Their object was to drain wealth away from the Indies to Europe; and, not content with the island possessions, they pressed their trade and forced an entry into the mature civilizations of India, China and, later, Japan. Military and naval power was used to enforce trade and exploit the territories. 'Trade was mistaken as a motive power when it is really a vehicle.' Here lay the chief mistake of Europe and America; all the later contacts with Asiatic peoples were wrong because of this blunder. Now world opinion has become tender about the rights of native peoples, and the need for replacing

military administration by self-government as soon as possible. East and West have met in the clash of world war. The expansion of Japan brought her into conflict with the expanding industrialism of Britain, the United States and Holland. So the policy which first touched the region when Cortez and all his men sighted the Pacific has turned the Basin into a battleground. The widening circles of imperialism have at last intersected; the needs and policies of the Eastern and Western worlds have clashed.

The only way to avoid war and to prevent conquest and exploitation is by greater knowledge and understanding. 'History is only geography set in motion,' wrote Herder; and we must set ourselves to the study of human geography and all that it implies. No field of study will yield a richer harvest than the countries of the Pacific Basin.

Malaysia, Indonesia, and Melanesia have great natural wealth. These lands produce foodstuffs and raw materials, or contain minerals which are essential to the industrial economy of other regions. The traders went to the Orient and the south-west Pacific in search of food for the factories of Europe and North America, and of the luxuries to which the people of the modern world have become accustomed. Those highly industrialized countries showed much greater interest in the exploitation of the resources than in the development of the peoples of Pacific countries. They are now showing an even more intense interest in the future control of the islands. The purpose of the following chapters is to give some of the reasons for this great interest.

CHAPTER VIII

PEOPLES AND PRODUCTS OF THE ARCHIPELAGO

MALAYA, Indonesia and Melanesia, are part of the folding which encircles the Pacific Ocean. Lines of crumpling may be traced. The main fold extends through the Malay Peninsula and ends in the small islands of Banka and Billiton. Another fold runs parallel to the Peninsula through Sumatra, and swings through Java, the Sunda Islands and Timor. Still others may be traced through Borneo, the Philippines and Formosa. It is in fact a region of extensive subsidence where the islands are merely the peaks, ridges and plateaux that escaped the drowning of the old continental margin. A deep trench passes between Borneo and Celebes; and, on the evidence afforded by the different plant and animal life on either side of this trench, Wallace, the naturalist, concluded that this marked the ancient division between Asia and the old Pacific continent. The evidence of such complete separation, however, is not as strong in many ways as Wallace thought. Lines of action from Sumatra east and south through Java, through the Moluccas, and north through the Philippines mark lines of weakness in the earth's crust.

This is the region of continuous heat and rain at all seasons. The saying is that 'it rains every day but there is never a wet day,' by which is meant that sunshine and rain alternate, often several times in the same day. Condensation from the warm, saturated uprising air gives the short, heavy tropical showers and frequent thunderstorms. These hot moist conditions produce the abundant plant growth of the tropical forests. Further away from the equator, the distri-

bution of rainfall is more seasonal, and the true monsoon effect appears. In Melanesia, on the edge of this region, the climate forms a transitional type between that of the mainland and the mid-Pacific trade-wind type. The annual range of temperature is very small, sometimes one degree only, and the rainfall in some islands is very low because of the presence of cold off-shore currents.

The distribution of the native peoples is an important factor in the development of these regions. Owing to the stepping-stone arrangement of the islands, and the restless, adventurous disposition of certain coast dwellers, the East Indies present a great mixture of types. The ease of access to the coastal regions is in marked contrast to the difficulty of penetrating the mountainous interiors and, as a consequence, the coastal and the inland peoples are in most cases of different races. The dark-skinned woolly or frizzy-haired people who inhabit the forest interior represent the early arrivals, while the lighter and very different immigrants of a later date are represented by Malay or Hindu Communities of a much higher type living on the coasts and lowlands. This, of course, is a very general statement that does not nearly account for the great human diversity found in Malaysia and Indonesia based on geography. The islands are but the piers of an ancient land-bridge which once connected, or almost connected, Asia and Australia. The racial groups were marooned on the piers as the bridge sank.

It seems likely that early waves of migration from Asia washed over a far more extensive terrain than now exists in the south-east. The tropical forests were then far more extensive, and it can be easily realized from a map how little crossing of water was involved. Those earliest adventurers were, quite possibly, tree-dwellers, short and small in build. The remnants of these people are the pygmies with the

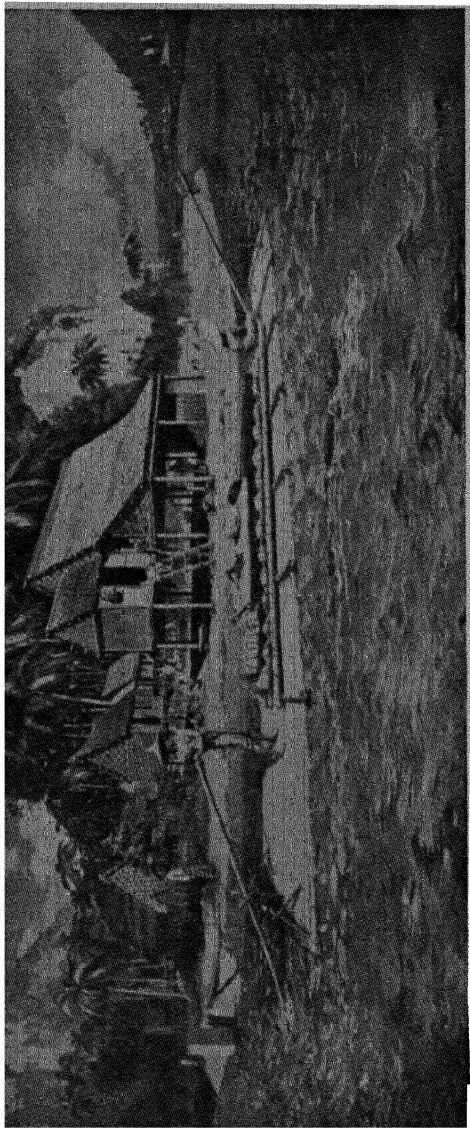


FIG. 24. A VILLAGE IN MALAYA

Note the well-constructed pile dwellings built off the ground for coolness and safety; the use made of bamboo in houses and raft; the heavy clouds; and the clothing of the natives.

'kinky' peppercorn hair still sheltered in the remote interior forests. Some of these, such as the Semangs and Sakis of the Malay Peninsula, are still largely tree-dwellers. Other migrations of stone-age man moved on to New Guinea, Australia and Tasmania. These were ground-dwelling hunters; and, although the Australian aborigines were more advanced than the Tasmanian, possessing a large assortment of bone and flint weapons and the curious boomerang, neither type had arrived at the bow and arrow stage, nor had either any notion of agriculture or the storing of food.

The basic stock of the islands were a small, round-headed, brown race called Nēsiots. The Malays who are of Mongolian origin, are most thickly settled in Malaya and Sumatra. They are more active and intelligent than most of the earlier types over whom they obtained a supremacy. Still later, as a result of the trading visits of Hindu merchants, extensive colonization took place in Java and Sumatra by Indian peoples. From this blend arise the Indonesians who are, by contrast with the Malays, an orderly and industrious people supplying the bulk of the labour now required on the plantations. Add to this ethnological patchwork a proportion of Chinese, who mainly appear in the rôle of merchants and miners, but have here and there become wealthy plantation owners and landlords employing quite large numbers of their countrymen. Then weave in a fringe of Arab traders who have been represented in the archipelago for centuries, and a broad idea will be gained of the very mixed populations which have now been feeling the impact of the white man for more than three centuries. The story of that impact, of the military control established in different times and places by Portuguese, Dutch and English trading companies, and the highly adventurous and romantic careers of men like James Brooke and Stamford Raffles cannot be related here.

The commercial and industrial infiltration by the white peoples will, however, demand attention in its appropriate place.

The whole region has taken on great economic importance in modern times because of the growing need of the great industrial countries for most of the products of tropical countries. As Lilian Knowles has said, an age that runs on rubber tyres, that prefers tea, coffee, and cocoa to wine, that needs the copra, quinine, and a thousand other highly important commodities that can be grown commercially only in tropical climates, is feeling an even greater dependence on equatorial lands. Of these, some areas of Malaya and Indonesia are particularly important because their fertile soils, their situation on trade routes, and their nearness to large bodies of cheap labour in India and China have made them attractive for the plantation method of developing tropical agriculture. The need for adequate and regular supplies of these tropical products has forced on the introduction of the plantation system. The old haphazard methods of collecting the products from the forests will not suffice when the supplies for large-scale production must be continuous and increasing. The industrial countries have thus been forced to go into these tropical lands to organize the agriculture; but at the risk of clash with native peasant farmers.

Malaya and Indonesia have also an extremely significant mineral production. Together with Bolivia, Malaya and some adjacent islands are the world's chief sources of tin. Further, although before the war the Dutch East Indies only produced about one-fortieth of the world's petroleum supply they possess the only oil deposits in the Western Pacific, and thus are of great strategic importance. The white man has entered the tropics to organize not merely the agriculture, but also the mines and enterprises

involved in developing these—the railways, the harbour facilities, and the shipping and related services. He must seek the assistance of native peoples in accomplishing these ends. Too often, in the past, he has chosen exploitation rather than co-operation; a stage has now been reached when the native peoples will no longer accept this system willingly. The Dutch, especially in Java, evolved a system of administration in which the native peoples play an active part; but exploitation has become tabu and methods fairer to the natives are replacing it. At the same time the plantation and its accompaniments of organization and education for industry have brought many benefits to native peoples.

CHAPTER IX

BRITISH MALAYA AND NORTH BORNEO

THE Malay Peninsula must be pictured as a mountain mass gouged and scooped in every direction by vigorous rivers fed by the tropical rains. A backbone of granite rises, forest-covered, to summits 8,000 feet above the sea, and divides the peninsula into a narrow coastal plain up to 30 miles wide on the west, fringed by mangroves and dismal mud-flats, and an eastern portion in which low, rolling hills end in a sandy coast-line. Towards the south the mountains flatten out into the plains of Johore. Ages of erosion have spilt on the lowlands the alluvial soil that is the basis of agriculture in this area. The tropical forest, sometimes dense jungle, is everywhere; and it is important to realize its density since it presents Man, the Pioneer, with his most difficult settlement problems. Climate, plant growth, and animal life are all hostile to his advance; and penetration, even by the most vigorous peoples, has been at best a slow

process. Indeed it was not until the white man appeared with his infinitely better equipment that the forest gave way at all perceptibly before man's onset.

Good descriptions of the equatorial forest are plentiful, and the following passage will help to form a picture of jungle conditions:

'In these immense forests of the tropical rainy regions the decay of vegetable matter during countless ages has enriched the soil to a depth of many feet, and from it has sprung a marvellous tangle of vegetation. Huge trees, shrubs, bushes, underwood, thorns and trailing vines all struggle to reach the light. Trees with lateral branches are rarely seen, but instead they shoot up, straight and smooth, for a hundred feet before branching out into a large cabbage-like top. Ferns, mosses, orchids, and other parasitic plants cover the trees from top to bottom. Immense rope-like vines, passing from tree to tree, up and down, some of them 600 feet long, bind the jungle in one big tangle. Orchid plants abound on every side, but to the observer on the ground their blossoms, like other flowers, are conspicuous by their absence. When the tropical jungle is examined from an aeroplane its beauty and wonderful colours would be seen in their full glory because the tops of the trees are often ablaze with blossoms.' (C. Wells.)

These forests are very extensive and rich in tree types, and more than 4,000 species have already been named throughout the archipelago. Comparatively few, however, are of any economic importance. The great bulk of the forest is composed of one family, the trees of which support, as it were, the roof of the forest. Many smaller species which manage to thrive in the shade, compose the several lower stories; and, below all these, riots the undergrowth. Most of the trees are hardwoods, and many yield products of great importance such as resin and gutta-percha. The rotan, usually spelled rattan, or climbing palm yields a product that used to be familiar in schools. No extensive

bamboo forests are found because there is no pronounced dry season. The most common palm—i.e. the coco-nut—is not a native of the tropical forest, and is encountered mainly on the coast and in the cultivated areas.

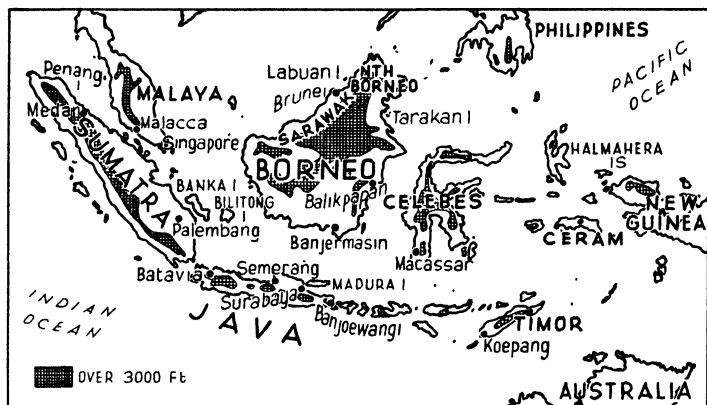


FIG. 25. INDONESIA

Within this vast forest home lives a great range of animal life. Such typical mammals as the elephant, rhinoceros, and tapir are numerous. It is the haunt of tigers and bears, and many varieties of deer, especially the dainty mouse-deer, a little animal hardly larger than a hare. Monkey tribes from the *siamang* or great ape to the long-tailed *lotung* and the domesticated *brok*, used by the natives for gathering coco-nuts, roam everywhere through the trees. Countless species of birds, too varied for description, inhabit the tree-tops; while below, reptiles from the great crocodiles of the swamps to the king-cobras and the giant lizards form the least attractive group of forest denizens.

The portion of the jungle that has been cleared for cultivation by man is still insignificant. Only in the alluvial

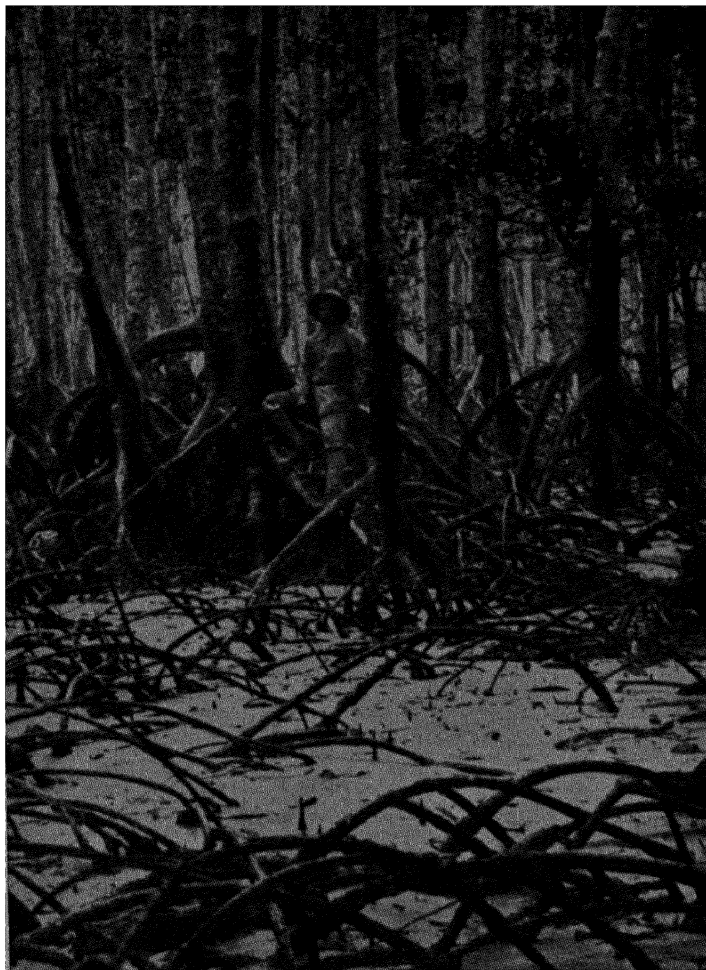


FIG. 26. MANGROVE FOREST

On the east coast of Malaya. Typical of low-lying coasts in the Tropics. Nature's 'reclamation plant' at work building up the shore-line.

valleys and on the coastal plain is agriculture general as yet. Rice, tapioca, and the coco-nut are there the main crops of the natives who, however, are unable to produce all the foodstuffs they require. Large quantities of rice and of animals and animal products have to be imported each year.

Under the direction of Europeans, Malaya became the scene of a great experiment in tropical agriculture. Coffee and sugar were first tried as plantation crops but the outcome was not very successful. Then came the wonderful success which attended the transplanting of the rubber tree—*Hevea brasiliensis*—an experiment from which the great plantations have grown which, before the war, produced two-fifths of the world rubber. The hevea tree grows best in deep, well-drained soil, at 600 feet above sea-level in tropical areas. The average annual temperature must be above 70° F. and the rainfall 70 inches or more, evenly spread throughout the year. Rubber growing is Malaya's main industry, on which all the resources of modern science have been brought to bear. The modern rubber plantation furnishes an object lesson in specialized work, from the carefully selected native labourers with their up-to-date houses and medical services to the army of scientific workers charged with the duty of safeguarding the flow of sap in perhaps half a million trees. Soil experts, agricultural chemists, botanists, entymologists, statisticians, and accountants all find a place in this modern forestry enterprise. In 1938, the total value of rubber exported from British Malaya was nearly £32 million. What this production meant to the United States, which prior to the war consumed more than half the total world output, and to other great rubber-using countries was only fully realized when the Japanese occupation of this area and of the other great producing area, the Dutch East Indies, interrupted the supply. The full extent of world dependence on rubber for

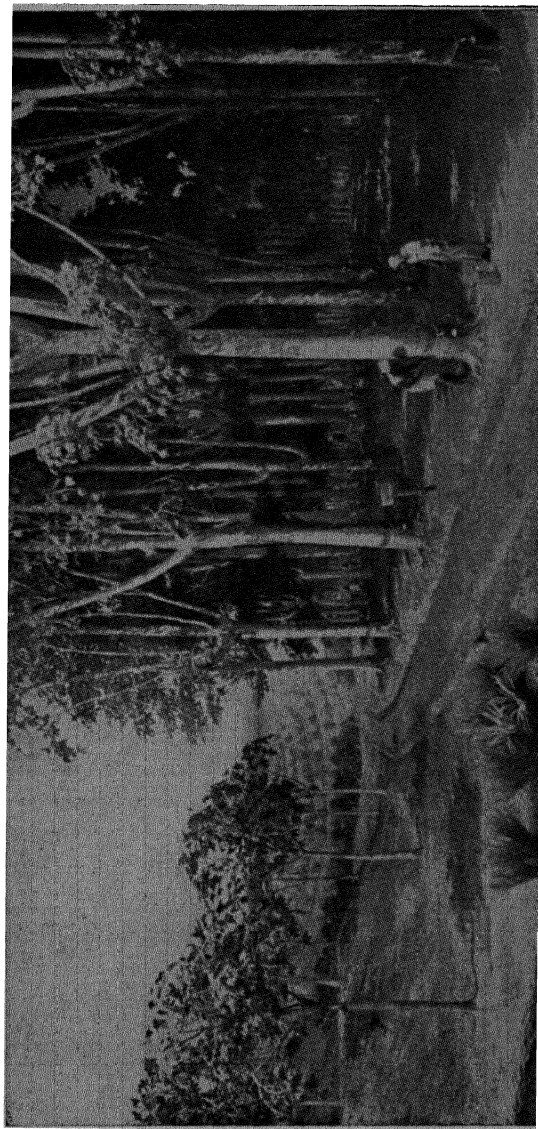


FIG. 27. RUBBER PLANTATION IN MALAYA

Note the careful numbering of each tree for sap records, the method of tapping, the type of plantation labour, the 'lay-out' of the plantation, and the 'contour-planting' in the background. What will the discovery of synthetic rubber mean to this industry?

mechanized transport, and a myriad other uses was shown when war stopped supply. Two other important crops are coco-nuts and palm oil. Plantations have been established in the coastal areas, and copra and palm oil both figure now on the list of exports. The forests produce several hardwoods which found an increasing market in Europe, and such forest products as gutta-percha, gums, wool oils, resins and canes are exported.

The peninsula is also an important source for another strategic commodity, tin. Under the alluvial soils of the lowlands, but on top of the granite bed-rock, are hidden those immense deposits which are the source of nearly half the world's supply. As in the case of rubber, the Japanese occupation of this area and of the Dutch East Indies forced the Allied Nations to seek alternative sources of supply. The chief methods of recovery in this region afford a contrast between the primitive sluicing of the Chinese fossickers and the costly dredging equipment of the big mining companies. Tin, however, is not by any means the only mineral wealth of the area, for coal, iron, gold, tungsten, and other minerals are mined in Malaya.

Politically the peninsula is divided into (i) the Straits Settlements, confined mainly to the southern half, of which Singapore has displaced Malacca as the main gateway; (ii) the Federated Malay States, formerly governed by native rulers under British protection and of which Kuala Lumpur is the chief town; (iii) the Unfederated Malay States, formerly governed by native rulers with British advisers. The city of Singapore (728,000) owes most of its importance to its situation at the bottleneck of east-west traffic. The city lies on a flat island about 26 miles long and 14 wide, separated from the mainland by a very narrow strait which is crossed by a causeway. It became a great

port for the East Indies, a busy coaling station, and one of the biggest oil-fuel distributing centres.) Its status normally depends largely on its situation as a point of transshipment.

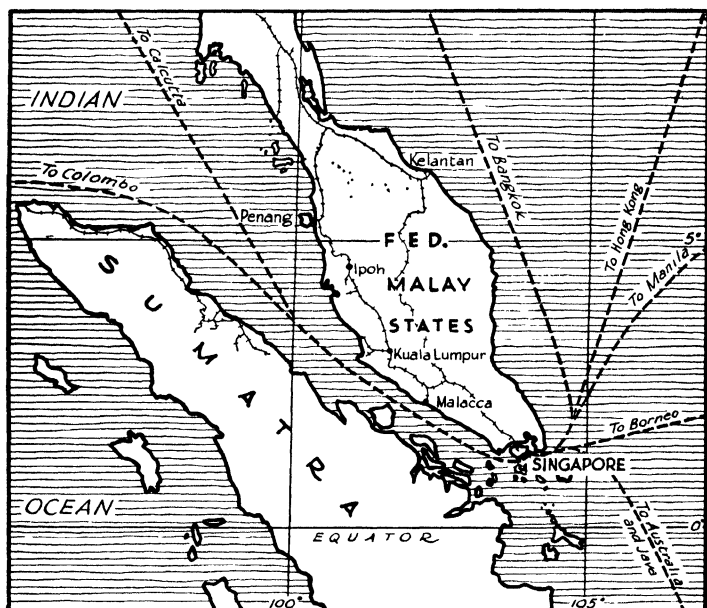


FIG. 28. THE POSITION OF SINGAPORE

Sir Stamford Raffles' prophecy that Singapore would become the bottleneck of the Pacific has been abundantly justified. It is to the western Pacific what Panama is to the American side.

The products of the archipelago are collected there, while the exports to the islands are there loaded from the large steamers into the smaller craft trading among the islands.

Smelting of tin and canning of locally grown pine-apples are important industries. The food and clothing for the five millions of people on the peninsula, and for millions

more represented by the outports, pass through its warehouses, which are largely in Chinese hands. By 1938 it ranked high among the ports of the world with its splendid harbour, great docks, and extensive coaling and loading facilities. In that year perhaps 30 million tons of shipping

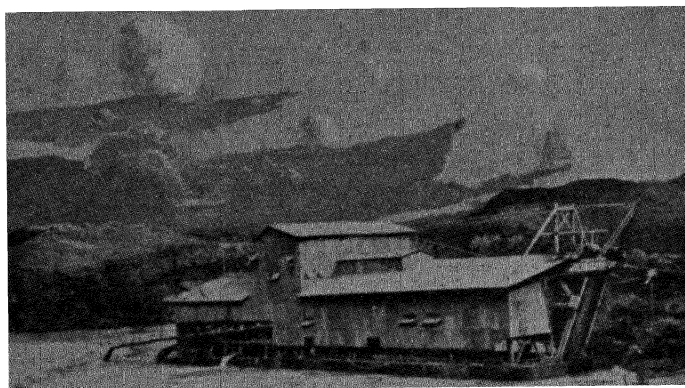


FIG. 29. TIN DREDGING IN MALAYA

Great wealth has been won in the 'harbours' from the alluvial sands washed down from the granite ranges of the peninsula. The dredges move across the silt-beds like a harvester over a wheat field.

entered this port, bringing motor spirit and manufactured goods of all descriptions in return for rubber, tin, hides, copra and the innumerable other products of the region. The old port, *Malacca* (43,000) has been displaced by the newer commercial centres, and now plays a minor part in the economic life of the area. The island of *Penang*, off the west coast of the peninsula, developed a large overseas trade in rubber, tin, spices and sugar. *Kuala Lumpur* (136,000) is well situated in the heart of a tin and rubber producing area. *Kuala Lumpur*, the former headquarters of

the government of the Federated Malay States, and *Ipo*h are the two chief centres for mining the tin which is smelted at Singapore and Penang before being exported. Copper and other minerals are mined in the vicinity, while coffee, rice and copra are trade staples.

It will be convenient before passing on to a survey of Indonesia to deal with the British territories in this area other than New Guinea. On the north side of the massive island of Borneo is a group of States whose relations to the British Crown are somewhat similar to those of the Malay Peninsula. These comprise (i) British North Borneo, a territory which before the Japanese occupation was under the direction of a chartered company; (ii) Brunei, a native state; (iii) the small island of Labuan, and (iv) Sarawak.

British influence in this region was strengthened after 1840, when steps had to be taken to suppress Malay piracy, which had become a serious menace to trade. The organization of Sarawak was successfully accomplished by an able and adventurous Englishman named James Brooke, who afterwards became the acknowledged rajah or ruler of the State. At the time of the Japanese occupation his descendants still ruled as independent administrators. Politically the term British Malaya includes not only the Federated and Unfederated Malay States, and the Straits Settlements of Malay proper, but also the dependencies and outlying islands of North Borneo. Sarawak is now a Crown Colony.

North Borneo is an extremely mountainous region. The mountain mass lies toward the north of the island, and Sarawak lies in the coastal region between the mountains and the sea. British North Borneo occupies a similar but more broken region at the extreme north of the island. With the exception of the more open uplands, the greater part of the island is a vast jungle watered by a network of

rivers. Much of the region has never been penetrated by white men. The rivers provide the only highways into the interior, and very little trade is carried on away from the river settlements. The chief products are timber, rubber and copra from plantations and, from Sarawak, a small amount of petroleum. Most of the trade is conducted through Singapore and Hong Kong.

CHAPTER X INDONESIA

1. *Historical*

HISTORICALLY, the penetration of white men into these islands is linked with the discovery of Australia. The Portuguese reached the archipelago in the sixteenth century, and were closely followed by the Dutch, who in the next hundred years established many trading ports in the islands. By 1640 Batavia had become a great centre of trade, and so important was the traffic to Holland that exploration was pushed on around all the coasts of Australia except the east. There were two main reasons for this: first, to chart them so that there would be less danger for their vessels, and, secondly, in the hope of finding new fields for trade. The most remarkable of these voyages was that of Abel Janszoon Tasman in 1642, when, with two ships, he sailed right round Australia via Mauritius, Tasmania and New Zealand without, however, sighting the eastern coast. It was a notable feat of navigation and exploration, and exemplifies the spirit of the early Dutch governors and traders. They laid the foundations of the Dutch colonial empire which has now become a new industrial region whose people may, in the near future, comprise the new Republic of Indonesia in association with the Netherlands.

2. *Relief, Climate and Vegetation*

Until the developments of the war in the Pacific attracted attention to these islands, their extent and economic importance was largely unrealized. To travel from the most easterly point of Sumatra to the most westerly point of Dutch New Guinea would involve a journey of over 3,000 miles, or about the distance by rail from Brisbane to Perth, from Liverpool to New York, or from New York to San Francisco. In extent Indonesia extends over more than twice the area of New South Wales or eight times that of Great Britain. Within this island empire are to be found all the products of which the tropics are capable, as well as mineral deposits of great industrial and strategic importance.

In population and productivity Java is easily the most important island in this group. Much of it consists of rock which is geologically young, but the most notable feature is the large number of active volcanoes which lie along the main axis of the island. This volcanic rock weathers very rapidly in the warm, moist climate, and thus furnishes the constituents of the very fertile soils which have given the island the name of 'the Garden of the East.' Climatically, Java has the small annual range of temperature characteristic of equatorial countries; temperature depends more on altitude than on season and a high humidity prevails at all times. Generally there are two seasons, a 'wet,' and a 'dry' receiving only slightly less rainfall. In the south the 'wet' season comes in with the south-east monsoon (July, August, September), while in the north it corresponds to the period of the north-west monsoon (December, January, February); but everywhere considerable local variations caused by highlands make anything but a detailed survey unsatisfactory.



FIG. 30. RICE NURSERY, JAVA

The women are lifting bundles of padi (rice) plants for transplanting to the flooded fields.



FIG. 31. FROM NURSERY TO RICE-FIELD

Carrying rice plants to the sawahs or rice-fields. The nursery is in front of the labourer; the field, flooded and ready for planting, at his back.

3. *Agriculture*

With such advantages Java is, naturally, a region of intensive cultivation, supporting one of the densest agricultural populations in the world. Rice is the chief crop; but the crop is insufficient to meet the food requirements of the people, and large quantities have to be imported. Much of the rice is grown under an ingenious system of irrigation made possible by bamboo pipes. Other crops grown as foodstuffs are maize, cassava (tapioca), potatoes, ground nuts, and tea. In the centre and east of the island, sugar cane competes with rice as a lowland crop; in order to protect the food supply the government prohibited an expansion of the acreage under sugar at the expense of rice and rigidly supervised a rotation of crops to prevent soil exhaustion. Coco-nut palms, kapok trees and many kinds of tropical fruits are prevalent in every lowland landscape. It is these lowland regions which support most of Java's forty millions of population. On the plains to the north the chief towns and ports are to be found, and it was here that most of the Dutch population was concentrated.

Beyond the alluvial plains are the foothills where, on the volcanic formations, every foot of land is put to good use. The terraced and irrigated 'sawahs' or padi-fields appear among rubber, tea, coffee, pine-apple and many other plantations. Tea ranks next to sugar cane in the list of plantation crops, most of it from western Java; the production of coffee, on the other hand, is concentrated among the hills of eastern Java where there is a fairly marked dry season of special importance in the growth of coffee. The area under rubber plantations in Java tripled between 1925 and 1938; but Sumatra is still a far more important source of supply. In 1938 the outer provinces, mainly Sumatra, still supplied more than three-fifths of the total rubber production



FIG. 32. TERRACED SAWAHS (RICE-FIELDS), JAVA
A perfect essay in soil conservation.



FIG. 33. RICE RIPE FOR HARVEST

of the Dutch islands. Where the volcanic soil gives place to limestone the great teak forests appear. Above this region again the so-called 'mountain cultures' extend to a height of about 5,000 feet above sea-level; and here plantations of tea, cinchona, vegetables of various kinds and suitable grains complete the wonderful Javanese agricultural system. Extensive patches of grassland are also common in the uplands, and these have naturally become grazing areas.

Under the tutelage of the Dutch administration all the techniques of modern agricultural science were brought into play, and very strict regulations had to be observed by the cultivator in order to maintain the fertility of the soil. The rotation of crops, proper irrigation methods, choice of seed and fertilizers are all watched closely by the administrators. It is in fact the greatest experiment in intensive cultivation that the world has to show. In the rice fields and plantations agriculture is carried on in a manner almost incredible to those accustomed to the extensive methods of cultivation employed in Canada and Australia. Nearly every plant is attended to separately; the garden or field becomes a nursery in a very real sense. At certain times long lines of patient labourers—men and women—work through the rows of growing plants, loosening the soil and removing insect pests. Machinery is used but little, and the maximum result is obtained from the soil by the sheer force of human muscles.

On the other islands, known as the Outlying Possessions, nothing so highly developed as the Javan system is to be found. This will be appreciated when it is mentioned that Java, and the small neighbouring island of Madura, comprising some 7 per cent. of the area of Netherlands East Indies or Insulinde, have over 60 per cent. of the total population.

By comparison, then, the Outlying Possessions are undeveloped and uncultivated. Most of the surface is still forest, or poor grass; and only on the coastal margins, and along the rivers, does agriculture exist, and mainly in the form of pioneer cultivation of a shifting kind (*caingin*).



FIG. 34. CUTTING SISAL HEMP

This results from the fact that Borneo and New Guinea lack the fertile basalt soils of Java. Another feature tending to retard development in most of the islands is presented by vast tracts of mangrove swamp which, in East Sumatra and along the entire coast of Borneo and many of the other islands, lie at the back of the coast-line.¹ However, the industrious and intelligent Javanese had developed a more

1. The mangrove is one of the most interesting features of tropical coast lands. This tree spreads by dropping branches to form roots, and these trap the silt brought down by the rivers. The mangrove is, in this way, the chief agent in building up silt deposits that will later become fertile alluvial plains along these coasts; and no other tree is capable of growing in salt water or of accomplishing this very important reclamation work.

advanced system of cultivation than the peoples of the neighbouring islands even before white men first discovered them. On the other islands the natives were not nearly so suitable as workers on the plantations and many Javanese have migrated to undertake this work. The Outer Provinces grow a much smaller range of plantation crops than is grown in Java. In this order, rubber, palm oil, coco-nuts, tea, tobacco and coffee are the six main products; to these might be added sisal, which is of increasing importance. The chief need for development in Indonesia is capital.

Sumatra is by far the most prominent plantation region outside Java. The main centre is the east coast which faces the Straits of Malacca, the avenue along which trade between the Orient and Europe passes. This particular area has fertile volcanic soil in contrast to most of the remainder of the island. Tobacco, rubber, palm oil and sisal are the main crops. On the west coast, many crops, but chiefly tea and coffee are grown. In Borneo and Dutch New Guinea the lack of volcanic soils will probably limit the staples to rubber and copra. The smaller, mountainous, and often semi-arid islands of the south-east are also much less suitable for settlement than Java or Sumatra. The island of Banda is still the outstanding producer of nutmeg and mace in the Archipelago, and Ambon and Ceram have still an important export of cloves. Throughout the Dutch East Indies the areas of cultivation are to a large extent determined by the rainfall, which is, in turn, decided by the height and direction of the mountain ranges. Even in this region of tropical climate, therefore, there are extensive patches lying in rain-shadow and forming areas of poor grassland. In Java itself the variation in rainfall from year to year is a problem for the cultivator. In some years the rainy period is much longer than in others.



FIG. 35. TOBACCO PLANTATION, JAVA

A hillside contour-ploughed, furrowed for drainage, and planted with tobacco. A neat piece of agricultural practice in tropical conditions.



FIG. 36. TOBACCO CULTIVATION, JAVA

Plants shaded from the direct sunlight and shielded from insect pests with cotton nets—possible only where labour is plentiful.

4. *Mining and Industrial Development*

Tin is mined at present on the islands of Banka, Billiton, and Singkep, but there are deposits on the adjacent islands and perhaps on the coast of Sumatra. The tin occurs in large alluvial deposits quite near the surface, and is easily

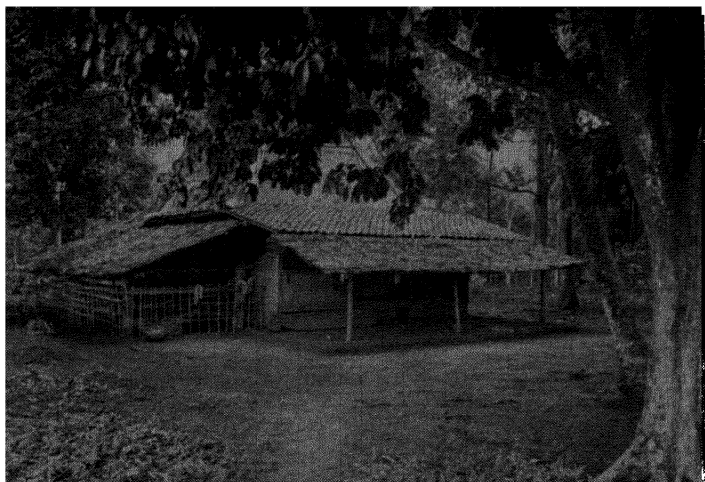


FIG. 37. JAVANESE HOUSE

Cheap, cool and dry, the typical bungalow also houses the live-stock under a lean-to.

worked. The metallic content of the ore is high; and, since the deposits occur near tidewater, it can be easily transferred to ships for smelting elsewhere if necessary. The tin from Banka, the largest producer, is smelted on the island; but that from the other islands was formerly smelted in Singapore and Penang, but since 1930 it has been treated overseas. Earlier, the mines were worked by hand labour, mainly by the Chinese, who are better adapted to this heavy work than the Malays. Now, the use of machines has

greatly reduced the coolie force. Sumatra is the major producer of petroleum, most of it coming from the Palembang fields. Eastern Borneo and the island of Tarakan (off the east coast of Borneo) are the second largest producers. Most of this oil is refined in the Indies. Bauxite (from which aluminium is derived) and nickel are both produced in easily worked open-pit mines, while fair-sized deposits of coal are being mined in Sumatra and south-east Borneo. The development of electric power has made strides in recent years. In the last ten years the energy developed has been doubled.

Until 1930 most of the industries in the Dutch East Indies consisted of traditional crafts and factories under European or Chinese management processing raw materials such as tin, sugar, and rice. Since that time there has been a marked expansion of both light and heavy industry, almost exclusively in Java. Articles such as furniture, hardware, sarongs, mats, cigarettes, beer, soap and bicycle tyres which were formerly imported from overseas are now being produced in Java to supply her own needs and increasingly for export to the Outer Provinces. This expansion of industrial production was greatly assisted by protective tariffs and technical information services.

5. *Foreign Trade*

Indonesia produces and exports three commodities of great strategic importance—rubber, tin, and petroleum—and has a practical monopoly of the production of cinchona (quinine), which is now largely displaced by synthetic anti-malarial drugs. This area together with Malaya produced about four-fifths of the world's plantation rubber which, despite the competition of synthetic rubber, maintains its importance for most uses. Malaya, too, is the world's largest producer of tin, a mineral of the utmost importance in the manufacture

of armaments and tinned plate for canned foods. Indonesia and Bolivia vie for second place; but in Bolivia, in contrast to the Indies, the ore occurs in deep veins high up in the Andes, and is of lower grade. The petroleum production of

INDONESIA: EFFECTS OF WAR UPON EXPORTS
Volume and Value of Selected Products

	1938		1947	
	Weight Million Kilogrammes	Value Million Guilders	Weight Million Kilogrammes	Value Million Guilders
Copra	566	39	153	79
Kapok	16	6	3	3
Rope Fibre	90	9	3 6	2.3
Coffee	70	14	4	.6
Rubber	320	156	85	67
Drugs and Spices	139	31	10	15
Sugar	1092	45	2	.9
Tea	82	57	3	5 6
Palm Oil	221	17	2 3	3 3
Petroleum	6067	163	764	61
Tobacco	50	40	2.2	4 3
All Other	2281	110	187 5	101
TOTAL	10994	687	1216	343

the Dutch East Indies, although such a small percentage of total world production, is of vital importance; it is the only production of any size in the Western Pacific area. The reserves in Borneo seem to be limited, but if New Guinea justifies expectations it may in time become a ranking producer.

6. *Government*

Up to the time of the Japanese occupation, the Netherlands East Indies were administered by a Governor-General, with the aid of an advisory council, both the Governor-General and the members of the council being appointed by the Queen. Another council, consisting of Europeans, natives and foreign orientals (Chinese and Arabs), some of whom



FIG. 38. HAND PRINTING FABRICS, JAVA

This method of stencilling cotton cloth in colours is known as batik.

were elected by local councils, gave advice on economic matters and discussed steps toward the development of self-government in the colony. The constitution of 1925 granted the Netherlands Indies a certain measure of self-government in internal affairs under the supervision of the Home Government. The islands were sub-divided into six governorships and these were further divided into residencies, the Governor and Residents having very extensive powers. The key-posts in the civil service were largely held by Europeans but local government was almost entirely exercised by native civil servants. The Dutch have encouraged the natives to administer their own affairs as much as possible and to limit the functions of Residents to supervision and advice. The former harsh rule which amounted to exploitation of the

natives gave place to a much more enlightened administration in which public education, health services, the promotion of agriculture and industry, and the supervision of the welfare of the natives are prominent features. When an attack on the Netherlands became a probability, the self-governing powers of the Indies were enhanced. This policy continued in the period between the fall of Holland in May, 1940, and the Japanese occupation of the Dutch East Indies early in 1942. A difficult post-war situation is not yet resolved. A federal constitution has been offered to Indonesia by the Dutch Government by 1950.



FIG. 39. WATER-BUFFALOES AND CHILDREN

Children perform the duties of herdsmen; and the fearsome-looking, ungainly beasts are always on the best of terms with their caretakers. The water-buffalo is the draught-animal of the rice lands; and crises occurred in the occupied lands because the Japanese slaughtered great numbers for meat.

CHAPTER XI

NEW GUINEA

1. *Physical and Climatic*

NEW GUINEA is a great undeveloped territory lying close to the Equator, and extending in a south-easterly direction for a total length of nearly 1,500 miles. Its greatest

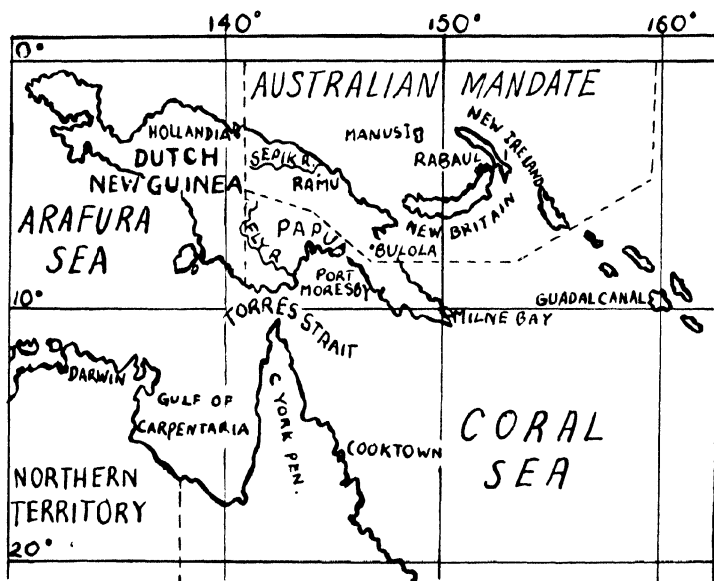


FIG. 40. NEW GUINEA AND THE AUSTRALIAN MANDATE.

width is about 500 miles. It embraces an area of 300,000 square miles, about the same area as that of New South Wales. It is wholly tropical in character, and possesses every variety of topography from low-lying swamps to towering mountain summits, 16,000 feet above sea-level. A complex mountain system runs east-west across the island,

occupying most of the northern portion and the northward and southward peninsulas. The main divide runs across the north centre of the island and is known variously as the Nassau Mountains in Dutch New Guinea, and as the Victor Emmanuel, Bismarck, and Owen Stanley Ranges in the Mandated Territory and Papua. The greatest heights are reached in the Nassau Mountains, but Mounts Blucher, Scratchley and Victoria are all over 13,000 feet. Another main chain extends eastwards along the north coast from Dutch New Guinea, and the different ranges have individual names, for example, the Torricelli Range and the Hahl Range.

The deltaic plains of the south side contrast with this mountain region. The largest rivers in the island are found in the southern division, and here they form the main highways. The Fly River, flowing into the Gulf of Papua, drains the greatest basin, and is navigable for small boats for more than 500 miles. Other rivers of importance in the southern lowlands are the Turama and the Purari, and all enter the Gulf of Papua by extensive deltas. On the north side of the island there are several splendid streams, such as the Sepik and the Ramu, flowing through extremely rugged country which everywhere extends almost to the coast. There is usually a sudden drop to a narrow, swampy coastal plain, some 50 miles in width. Owing to the more mountainous nature of the northern part of the island, it is even less developed and explored than the south. On the other hand, much of the lowland along the coasts and in the lower river valleys, both in the north and south, is too swampy for cultivation. Further, these swamp areas are particularly dangerous to Europeans, and malaria is prevalent all over the island up to heights of 2,000 feet. The good land exists in patches—on well-drained alluvium along the coast, and on

volcanic and other fertile soils up to an elevation of about 5,000 feet.

In taking up land in one of these favoured areas, the planter has to face many difficulties. One of these is the climate. There are only small differences in temperature

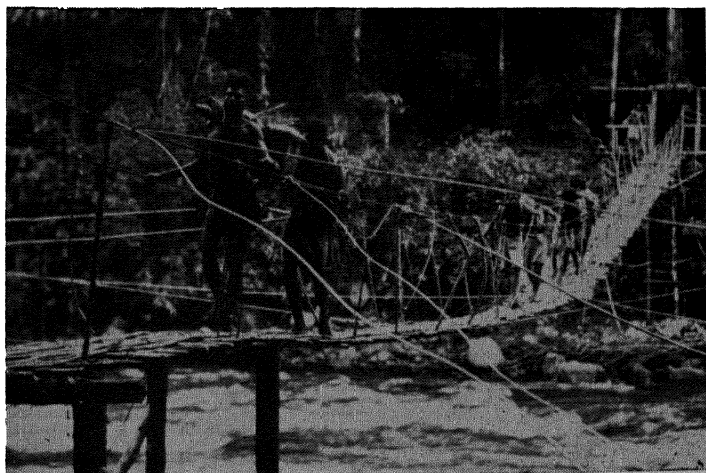


FIG. 41. TRANSPORT IN THE JUNGLE

Dense jungle and deep ravines make transport extremely difficult. Even in the most settled parts of the island, bridges are rare because of the fast-rising streams. If a bridge is washed away during the rainy season, another is quickly slung together.

throughout the year, and there is no cool season. Added to this, there is generally no marked dry season and the humidity remains continually oppressive. At Rabaul, the relative humidity never falls below 79 per cent. for any month, and even at Port Moresby the lowest figure is 70 per cent. The amount and distribution of rainfall is markedly influenced by topography, some areas receiving most of their rain between December and March, the period of the north-

westerly monsoon, others between June and October when the south-east Trades are in operation. Some regions receive a much lower rainfall than neighbouring areas, and this is thought to be due to the arrangement of the mountains. Port Moresby with an annual rainfall of only 40 inches is in one of these so-called 'dry belts'; but there is an acute water shortage in the drier months, so that it has been necessary to construct a reservoir in the hills above the town. However, for the island generally the rainfall is 80 inches or more, rising to 250 inches on the mountain peaks.

2. *People*

The natives of New Guinea and the adjacent islands differ very markedly from those of the remainder of the East Indian Archipelago. The general name of Papuans, from a Malay word meaning woolly-haired, is applied to them; but a distinction should be made between two main groups, the Papuans and Melanesians. The Papuans proper belong mainly to the interior and are presumed to be the aboriginal race. They are very closely allied to the aboriginals of Australia. Formerly notorious for their tribal warfare and cannibalism, under the influence of the British and Dutch administration more and more of their disputes are being settled by agreement, and cannibalism is dying out. Some of the other interior tribes are pigmies, with an average height of only 4 ft. 8 in. The Melanesians, who are mainly coast-dwellers, are in general darker and frizzy-haired, while in the smaller islands a great admixture of Polynesian, Malay, and even Chinese has taken place. This is merely a broad classification which does not attempt to account for the great diversity of skin colour from light brown to intense black, nor for the extraordinary number of languages found in the island. 'Pidgin' English is the usual expedient for communication between whites and natives.

The natives in the settled districts have been induced to abandon their old tribal warfare. Most of them are energetic and of good physique but are very susceptible to the tropical diseases so prevalent in the island. The western and coastal peoples are, generally speaking, taller and better developed than those living in the interior. They live for the most

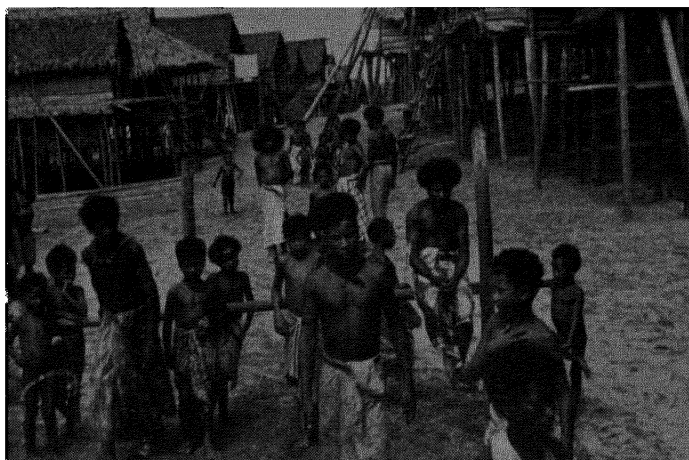


FIG. 42. The 'Main Street' of a New Guinea village.

part in villages which vary in size from a few families to a settlement of a thousand persons. Many of the tribes in the centre and the west have very large communal houses. In the Fly River district, in particular, a great number of families will inhabit a large dwelling over 500 feet long and divided into compartments for each family. This custom is also practised, for instance, by some of the tribes of Borneo.

Closer observation of the natives of New Guinea has led to a revision of the earlier opinion that they were "among the lowest classes of savages". Contact between the natives and

Allied soldiers in the present war has shown the natives to be willing and worthy of trust. Their architecture and art is of a high order for primitive peoples. They have developed very special skills for deriving a livelihood from their difficult environment, and cultivate garden plots of fruits and vegetables on land cleared of jungle. No reliable estimate of their numbers has yet been made, and although the island possesses a large population, extensive areas are uninhabited.

3. *Natural Vegetation and Agriculture*

Both the fauna and flora of New Guinea are truly Australian in character. The animals include such distinctive types as the egg-laying mammals and the marsupials. The Asiatic types of Borneo and the western Archipelago are absent, most noticeably the monkey types. Birds such as the cassowary, the scrub-turkey, and the parrot in endless variety also display the natural affinity with the mainland of Australia. A peculiar and characteristic species, however, is the gorgeously coloured bird of paradise, which has suffered so greatly as a result of the contact of New Guinea with civilization. The vegetation is also largely blended with Australian forms such as the eucalypt. The island is generally forested except in the 'dry belts' and in areas cleared by the natives but not re-invaded by secondary growth. Here, the surface is covered with a tangled mass of cane and grass. Tall trees are found at a height of 8,000 feet, while a species of pine grows as far up as 10,000 feet. The island abounds in plants and timbers of a high economic value, but, up to the outbreak of war, no serious attempt had been made to exploit or even survey the resources. Because of the difficulties of exploitation, milling in New Guinea may be a matter for public rather than private enterprise. Up to date, only

a few species, such as the dense ulabo which resists the white ant, have been cut. The delta country is covered with a thick jungle of nipa and pandanus palms, and other trees tangled like the forest on higher land in a riotous mass of rattans and other creepers. The coast vegetation is mainly mangrove and palms.

The areas of fertile soil along the coast and in the valleys afford great possibilities for the development of tropical agriculture, although the acreage of good land has not yet been ascertained. By reason of the distribution of good soils at varying levels, every tropical crop could be grown on the island. At present coco-nuts are the predominant crop of both Papua and the Mandated Territory. The acreage under crops in Papua has changed little in the past twenty years and 50 per cent. of this is under coco-nuts. The Mandated Territory, with an acreage under coco-nut plantations four times that of Papua, has established an export trade in both copra and desiccated coco-nut. Most of the remainder of Papua's cultivated area is under rubber. The 'dry belt' around Moresby is suited to the production of tobacco, sisal hemp, kapok, cotton, coffee, and sugar. In the Mandated Territory, the growth of crops other than coco-nuts is still largely in the experimental stage, but a wide variety of these, including cocoa, coffee, cinchona and vanilla, are proving successful. In Dutch New Guinea, plantation agriculture has scarcely begun. Throughout the island, various edible fruits and roots including yams, bananas, and bread-fruit are grown. The main food of the natives in the south is sweet potatoes, while in the west it is chiefly sago, obtained from the nipa palm. All along the coasts the natives catch fish, and small amounts of bêche-de-mer and trochus shell are exported.

4. *Minerals, Settlement and Government*

A wide variety of minerals has been discovered in New Guinea including gold, osmiridium, copper, tin, lead and zinc, while the search for petroleum is being diligently carried on. However, so far gold mining is the only mining



FIG. 43. PAPUAN NATIVES FISHING

Papuan natives catch fish to vary their diet. They dive in and catch the fish in hand-nets.

enterprise of importance. The main field is in the neighbourhood of Wau, on the mountainous backbone of the island; the nearest port is Salamaua, and, owing to the inaccessibility of the region, the main transport of passengers, supplies, and machinery is by air from Lae. The difficulties of overland transport and of maintenance of life in isolated regions makes mining a venture for large-scale concerns. Many of the rivers in Papua, except those flowing into the Gulf, have been thrown open for gold-dredging and good

yields have been obtained. Should the present search for oil bring to light extensive deposits, the opening up of the interior would proceed far more rapidly.

Politically, the island is divided into three areas. The western half forms a Dutch possession, and is the least developed and mainly unexplored. Until the Japanese occupation the territory was administered by the Governorship of the 'Great East,' as those islands of the East Indies are called, through the Resident at Ambon. South of the mountains, lying around the Gulf of Papua and extending through the south-eastern Peninsula, is the dependency of the Commonwealth of Australia known as Papua. The remainder of the island was formerly a German possession, but it is now administered by the Australian Government under the United Nations but the precise form of the trusteeship is not yet decided.

The main settlements of importance are the trading and administrative centres situated around the coast. *Port Moresby* is the capital of Papua, situated on a fine harbour to the east of the Gulf. Samarai, a small island off the south-east extremity of New Guinea proper, has become a trading centre for several small groups of adjacent islands. The chief centres of settlement in the Mandated Territory are *Morobe*, *Salamaua*, *Wau* and *Lae*, in the Morobe district, and *Madang*. The administrative centre was formerly at Rabaul, on the island of New Britain, but after the volcanic eruptions of June, 1937, it was decided to transfer the seat of government to Salamaua.

Other settlements are mainly along the coast of the mainland and larger islands, since most traffic is water-borne. Many of the upland districts, however, are bound to become productive once the great problem of transport is solved. Air and motor transport may do for New Guinea what the

railway has done for Central Africa. Up to the present, however, copra has been the mainstay of the Territory, and, since the coco-nut palm from which it is derived thrives on the coastal lowlands, development of the highlands has been slow. It has been the aeroplane which has opened up the

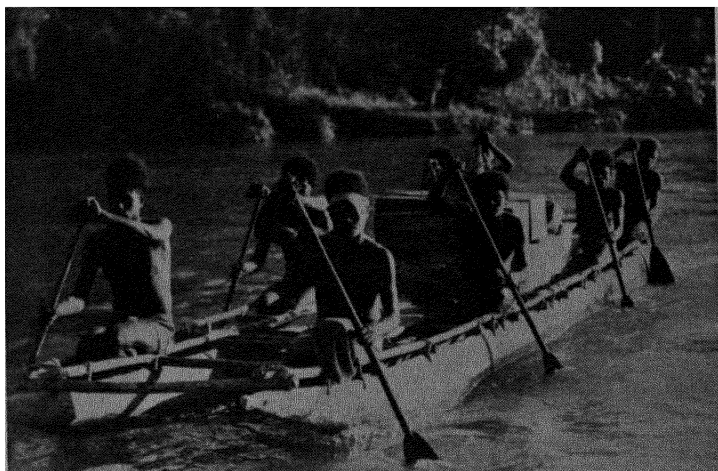


FIG. 44. NEW GUINEA RIVER TRANSPORT

The rivers form the main 'highways.' Natives make their way upstream in an out-rigger canoe.

gold fields of the interior. Machinery, livestock, all types of supplies, and passengers were brought to the fields by air, doing away with the need for the long and difficult journey overland through the jungle.

Another great problem for the planter is the supply of labour. The different native peoples vary greatly in their adaptability to plantation conditions, and the press-gang methods of the past did not have the effect of securing goodwill towards the planter. The control of native labour

in the areas under British jurisdiction is now very strict. Service on the part of the native is voluntary, and he must be justly treated, and properly housed and fed. Contracts for service must be made in writing before a government official, and the natives must be returned to their homes on completion of the engagement. Steps have been taken to provide education for the natives, and more especially to give instruction in tropical agriculture. Health facilities include hospitals, dispensing of medical supplies, and training of natives as medical orderlies. Under the terms of its mandate the Australian Government is obliged to administer the Mandated Territory in such a way as to 'promote to the utmost the material and moral well-being of the inhabitants.' By working along these lines, the government has fostered a spirit of co-operation between the natives and the whites, although, owing to their experiences during World War II the natives are more sophisticated and resistant.

Dutch New Guinea

The development of Dutch New Guinea is not so far advanced as that of the rest of the island. On the coast there are coco-nut plantations, and copra as yet forms the only important product. The development of agriculture has been handicapped by the lack of volcanic soil found in the other parts of the East Indies, and by the fact that the natives are too primitive to be employed on plantations. The natural features of the interior make communication extremely difficult. The main mountain chain divides the north from the south, while the deep gorges of the rivers make overland transport a matter of great difficulty, apart altogether from the problems presented by the dense jungle and the steamy climate. Since 1936, a considerable amount of exploration and experimentation has been carried on by

the Netherlands Indies Government. Large areas have been mapped by aerial survey; and experimental plantations were established to determine the suitability of such crops as rubber, kapok, and coffee to the environment. The search for minerals is also being pushed forward. The Netherlands New Guinea Petroleum Company has obtained exclusive drilling rights for a large area on the Humboldt Bay and has been intensively exploring the area. Also, the Mining Company of Netherlands New Guinea secured a concession in the southern part of the area, where it is hoping to exploit certain minerals, particularly gold.

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PART III

AUSTRALIA

INTRODUCTION

ONE result of Japan's challenge to the other Powers for the mastery of the Pacific has been to thrust Australia into a new and more important position both in the Pacific region and in world affairs. For more than a century Australians have been concerned mainly in developing their continent, with all the hardships of exploration and pioneering, of discovering and using the resources of the country, of providing the permanent equipment of settlement, and of finding their place in the world economy by way of trade. For a decade they have been forced to consider the problems of defence. These problems took on great urgency after 1940, when this island continent was for a time actually under blockade. Its people were forced to rely upon their own resources until Britain and the United States had organized their own defence and were able to send assistance.

The reasons for the new strategic significance of Australia must be told mainly in terms of place and products. The contribution Australia could make towards the defeat of Japan was, in fact, determined by both situation and resources; but long before the war Australia was playing an increasingly important part both as a producer and a consumer of commodities that enter into world trade. The strategic position of the continent is the effect of geography alone—of its situation in the Pacific with relation to other countries and, in particular, to the islands of the East Indies and Melanesia. It is the only land mass outside the arc of islands which became Japan's advanced screen; and so it inevitably became the supply base for defence and the 'springboard' for counter-attack upon the Japanese system. Its isolated position

between the Indian and South Pacific Oceans—formerly a weakness—now became an advantage, since it lay so far south of Japan that its investment called for long supply lines even though for the greater part of their length they were protected by the island screen. Australia immediately assumed vital strategic importance to all the Powers whose dependencies had been overrun or menaced by Japan; and its usefulness was increasingly proved as the war in the Pacific developed.

A second aspect of Australia's new significance was its position as the home of the largest English-speaking population in the southern Pacific. The expansion of England had in fact thrust a spearhead of European civilization into the South Seas; but immediately to the north and north-west lay Asia and the islands with 1,100 millions of people. Such a situation is at best precarious, even more precarious than that of Great Britain in relation to Europe. The Australian people find it hard ever to lose sight of this aspect of their situation. They feel they are also exposed in other ways. Economically they are still very dependent upon the people of other countries. For a century their main concern was pastoral, agricultural, and mining development in order to build up the productivity of the country. Exports of wool, metals, wheat, butter, fruit, timber and other products were needed to pay for imports of manufactures and to meet the interest on capital borrowed from Britain. But a time came when rural industry could no longer support all the people, and factory industries were needed to provide wider and more varied employment opportunities. Since 1900 industrialization has gone ahead at a rapid pace; but Australians still need overseas markets for their surplus primary products, and they will be intensely interested in world economic conditions for as far ahead as they can see.

Moreover, progress in manufacturing has made Australia the main industrial country of the south Pacific, and her importance in this respect must grow rather than diminish, especially if it proves impossible to banish the threat of war from the world. The resources of the continent, the energy and technical skill of its people, the industries which can be converted to the production of munitions and equipment, and the supplies of foodstuffs that are available all point towards new interests and functions in the world. The Australian people now feel a new urgency to express their views about the future of the Pacific. They wish to retain their connection with Great Britain and the Empire; but their position in the Pacific brings them new responsibilities. They cannot 'contract out of Europe' even if they wished; but they are anxious to strengthen their friendships with the United States, Canada, Indonesia, China, Russia, and indeed with any country which will plan for security and stability in the Pacific.

This will not be easy. A people's political system, its social welfare and its international relations are in these days closely tied up with its economic conditions; and great changes are afoot. Transport and communication by air has altered the whole scale of time-distance, and has accelerated both co-operation and competition of all kinds. The old familiar natural products of the farm or the factory are threatened; and so also are great established industries. The sheep industry in Australia is based on the demand for wool, the plantation industry of Malaya depends on the industrial need for rubber, the silk industry of Japan and China relies upon a steady need from America and Europe, the mining industries everywhere produce for the great modern consumption of metals. But the chemist and physicist have set up rival industries. Rayon, staple fibres, synthetic rubber,

plastics, are already displacing the materials and metals that seemed so secure.

These are the changes we can see, those that are already at work. What of those we cannot foresee when science has discovered new raw materials, industry has perfected new processes, and atomic power becomes available to the world? What is the future of the wheat farmer, the wool grower, the rubber planter, and the miner? Countries like Australia and New Zealand realize that these changes will affect their way of life and their prosperity, and know that they must adapt themselves, their occupations, and their policies in order to take a full share in world co-operation; but they harbour no illusions about the difficulties ahead.

CHAPTER XII

PHYSICAL AND CLIMATIC

I. BUILD AND SURFACE

ALTHOUGH the youngest of the continents in point of discovery and settlement by European races, Australia is one of the oldest geologically. The great movements of upheaval, and the volcanic activity still evident in other parts of the earth's crust, died out long ago in Australia. Upon its vastly old rock masses the forces of wind and water have been at work so long that traces of youth have now vanished. The general level is much lower than that of any of the other continents; and this fact alone does much to determine the general conditions of life in Australia. As everywhere, surface is second only to climate in fixing the character and distribution of the plant and animal life. It has, therefore, much to do with the numbers of the people and where they

live. The build of the continent is also the chief record of its history. Soils everywhere have been eroded and exhausted and lost elements can only be replaced with great care and cost.

If the South Polar continent is excluded, Australia is the loneliest of the world's great land areas. Contact with any

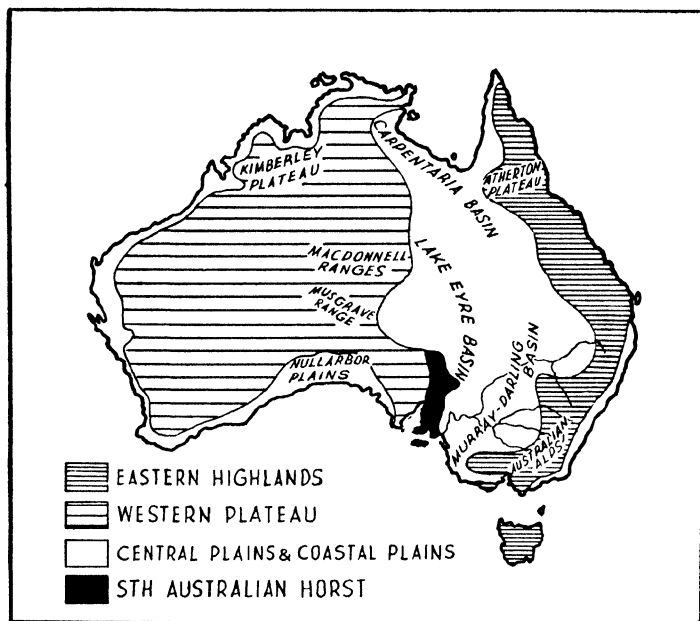


FIG. 45. THE BUILD OF AUSTRALIA

of the large centres of population is possible only by long sea or air voyages that merely emphasize the geographic isolation of the 'great south land.' This isolation, of course, greatly retarded the discovery and settlement of Australia; but it is, nevertheless, a big compact mass about 2,400 miles from east to west, and a little less than 2,000 miles in greatest length from north to south. This gives a total area of

approximately three million square miles, or about the same as that of the United States or Canada.

The surface falls into three well-defined areas: (i) the Western Plateau, composed for the most part of immensely old rocks, and extending over nearly half the total area of the continent; (ii) the Eastern Highlands, the remains of a great upward warping of the crust, broken by much block faulting, and now planed down and levelled by erosion; and (iii) an intermediate lowland area, the surface of which is composed largely of the sediments resulting from this erosion and deposited in an ancient sea-bed. Something more should be said about each of these divisions before the climate of the continent is discussed.

1. *The Western Plateau*

This great area, standing at an average height of a little less than a thousand feet above sea-level, is composed of some of the most ancient rocks in the world. It is, as it were, an old, hard anvil against which the surrounding parts of the crust have been crushed and contorted. As a result of the extreme dryness of the climate over most of the plateau, wind erosion, in particular, has been very active; and the loose soil has filled up the depressions and levelled the surface of the country. The area is rather like a huge inverted plate with a very low coastal rim and central bump; and so most of the drainage is inland, although the scanty rainfall and high evaporation is against the formation of rivers. The plateau is fringed on the coastwise edges by a narrow plain formed by the alluvium carried down by the rivers draining the seaward slope or, as in the north-west, by the *loess* blown seaward by the prevailing winds. Even the coastal rivers, however, are unimpressive since, in the dry season, they become mere chains of water-holes or even dry channels for months at a time.

2. *The Eastern Highlands*

Running at varying distances from the east and south-east coasts is a second highland area of a very different kind. In Australia there are no high mountain systems; the 'Alpine Storm' which produced the great mountain ranges, such as the European Alps, the Himalayas and the Rockies-Andes fold, passed Australia by. Many millions of years ago, Australia was a huge flat peneplain with great bosses or caps which had resisted erosion better than the softer rocks, and formed a watershed nearer the eastern coast than the present height of land. Later a thrust from the east pushed up the crust in a broad warp, which broke into complex fault blocks. Since then, through erosion, the highlands have become a series of dissected plateaus with worn-down summits—the "mere stumps of their former greatness". The greatest heights of the present cordillera are in the south-east corner, but they are more of the nature of humps on the surface of a plateau.

Farther to the north the plateau presents towards the Pacific that steep, scarp-like face that proved such a barrier to the earlier settlers, confining them as it did to the narrow coastal strip until Blaxland, Cunningham, and others discovered the routes to the interior. Over this escarpment the plateau proved to have an even surface, dissected by the gorges of the streams, but sloping back gently to the central plains. The gaps in the plateau edge have become the main gateways leading from the Pacific coast to the hinterland. These are, from the north—the Cassilis Gap behind Newcastle, the Lake George gateway near Canberra, the saddle on which Cooma stands, the pass through the Australian Alps by Omeo, and the Kilmore Gap due north of Melbourne. Still farther north in Queensland the highland region is rolled out, as it were, and is generally lower than the southern

half of the cordillera, except where it fronts the coastal edge in the Atherton Plateau and the ranges behind Maryborough. The whole seaboard in its drowned-valley harbours and barrier reefs bears the marks of a great sinking movement in which, probably, Tasmania was cut off from the mainland.

3. *The Central Lowlands*

The central depression between the eastern and western highlands is one of the largest expanses of true plain country in the world. It comprises a series of shallow drainage basins stretching from the Gulf of Carpentaria to the Southern Ocean, and from the Darling Downs to the west of Lake Eyre—a great expanse covering almost a third of the continent. The plains north of Lake Eyre are built of sediments deposited in an ancient sea which may once have completely divided the continent. Part of the area drains north into the shallow basin known as the Gulf of Carpentaria, but the major portion belongs to the inland drainage system of Lake Eyre. The Great Artesian Basin, so called from the presence of subterranean water upon which the region is dependent, occurs in the north-eastern part of the Central Basin. A second basin lies in the south-eastern elbow of the Great Divide, and drains away through the wide plain of the Murray and Darling Rivers, and an old raised sea-bed which lies between the confluence and the sea. Hence it is known as the Murray-Darling Basin.

A minor highland system that is nevertheless of much economic importance lies to the west of the Murray-Darling Basin, and is separated from the south-east corner of the Western Plateau by the Great Sunkland of South Australia in which lie Spencer Gulf and Lake Torrens. This system is known as the South Australian Highlands, which ends to the north in the Flinders Range and to the south in Kangaroo

Island. Another shallow basin is scooped out of the southern edge of the Western Plateau, and forms the weird, monotonous Nullarbor Plain across which the transcontinental railway runs north of the Great Australian Bight.

II. THE CLIMATE OF AUSTRALIA

In a country ranging through nearly 2,000 miles of latitude a great variety of climate would be expected. The Tropic of Capricorn marks about the central axis of the continent; and, speaking generally, the climate for such a great area is remarkably uniform. Its island nature, and the lack of any great heights, are other factors which help to regulate the climate of Australia. This may be described as warm to hot; but in general it is cooler than other regions in corresponding latitudes. Only in the south-east and south-west, and in the highlands, is the cold season at all well marked. By way of contrast, it is only on the coastal lowlands within the tropics that physical discomfort discourages occupation by white people.

Because it is an island, with greatest width east and west, and because it is a relatively small continent, only a comparatively small portion of the whole area is more than 500 miles from the nearest ocean, and the moderating influence of the ocean is carried far inland except in the north-west. On the eastern side warmer conditions are carried as far south as Tasmania by the East Australian branch of the Equatorial Current. The greater part of the southern coast comes under the influence of the cold westward drift. The relatively low mountains, furthermore, are not such pronounced obstructions to air circulation as the great heights along the western edge of the Americas.

The most powerful influences, therefore, are the tropical trade-wind circulation in the north, and the westerly wind

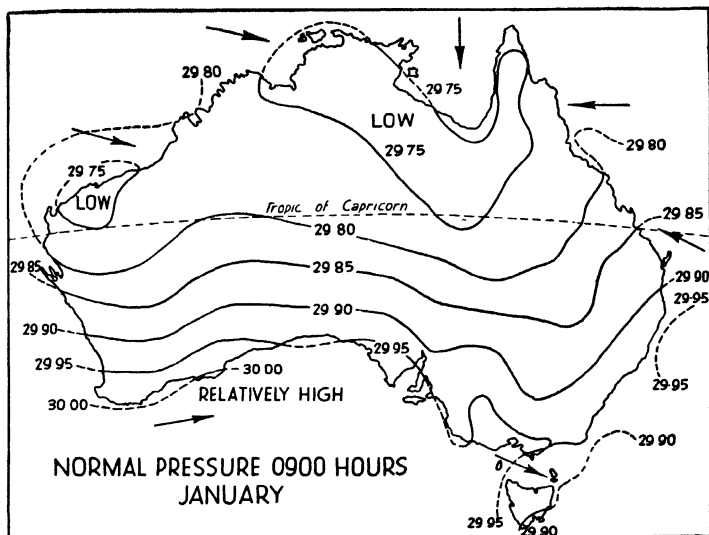


FIG. 46. AVERAGE PRESSURE AT 9 A.M., JANUARY

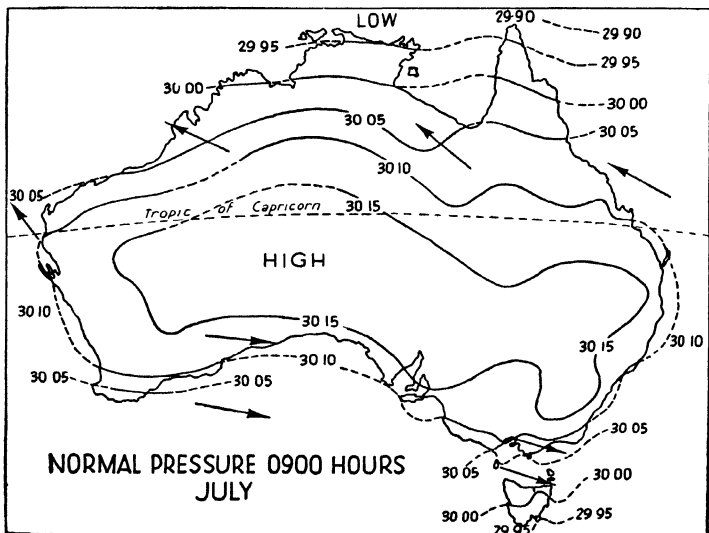


FIG. 47. AVERAGE PRESSURE AT 9 A.M., JULY

system in the south. The connection between these and the swing of the whole system north and south with the sun have been discussed in chapter IV. Viewed broadly, the result is that in the warm season, i.e. from November to April, the equatorial air currents are drawn down over northern Australia; and at the same time the westerlies are pushed far to the south of the continent. In the cool season, i.e. from May to October, the equatorial system swings away over Asia; and the westerlies are dragged north over the southern half of Australia. These great swings bring about the characteristic seasonal changes and determine the way in which rainfall is distributed over the continent and throughout the year.

Over northern Australia the inflowing winds in the hot season bring the heavy monsoonal rainfall which is such a contrast to the rainless months of the cooler season with its off-shore winds. The coastal areas fronting the highlands in Queensland thus receive the heaviest rainfall in Australia; but, except for the Queensland coast, the alternation of rain and drought is a very real handicap to development. On the other hand, the moderate rainfall of the south is associated with the 'low pressures' of the westerly drift, mainly in winter and spring, while more or less prolonged drought tends to be normal in summer.

Generally speaking, the winds on the Pacific coast are on-shore for most of the year, and represent the play of the trade winds as the whole system swings north and south. The presence of the warm current flowing to the south along the edge of the continent has some significance because the winds bring ashore the warm saturated air which passes over the coastal highlands of the Great Divide. Hence the east coast receives an adequate rainfall fairly evenly distributed throughout the year. On the contrary, the southern and

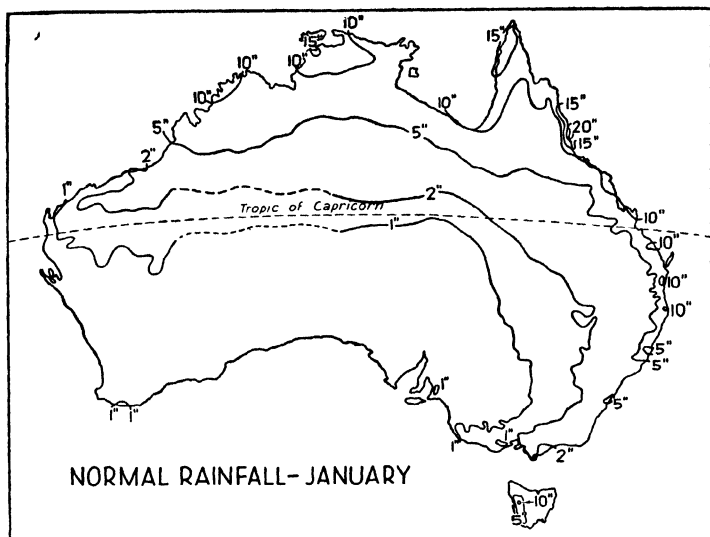


FIG. 48

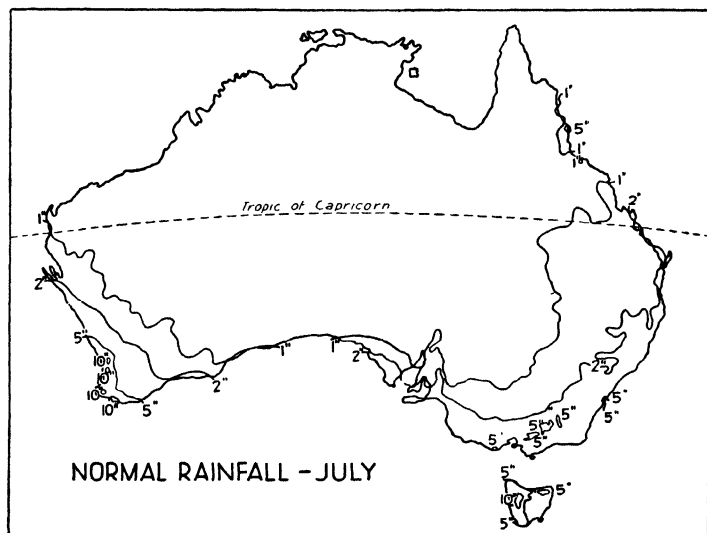


FIG. 49

western shores of the western half of Australia are subject to winds flowing over cold currents before they reach the land. The air temperature is raised as it passes overland; and, consequently, these winds tend to absorb rather than to deposit moisture. The contrast is pointed by the rainfall figures, e.g. Eucla with 10 inches annually is to be contrasted with Sydney in about the same latitude, but with an annual fall of about 50 inches.

A feature of the climate of southern Australia is the association of the rainfall with storms known to meteorologists as 'Lows' or 'Cyclones' because of the low barometric pressure and the generally circular movement of the winds in the systems. These 'Lows' are huge eddies carried along in the air stream, not unlike whirlpools in a fast current, each whirlpool revolving round its own vortex, and at the same time being carried along with the stream. These swirls in the westerly drift drive warm moist air from the north up over cold air from the south and rain results. They move to the east at varying speeds, but the track followed is by no means constant for different 'Lows' nor regular for any one 'Low.' In an effort to fill the 'Low,' air from all directions flows into the area of low pressure in a clock-wise spiral. In a longer or shorter time, the 'Low' moves on and is succeeded by a high pressure system. It follows that a place in southern Australia will experience northerly winds as the 'Low' approaches, followed by squally Westerlies, and then cool Southerlies after the centre has passed.

These disturbances affect the southern half of the continent with remarkable regularity, sometimes crossing farther to the north, and drawing the cold southerly influences far inland, sometimes passing farther to the south and leaving the interior and southern areas open to tropical influences. As the 'Lows' pass eastward they are followed by southerly

winds with cold rains, and frequently snow in the highlands. The high pressure then gradually asserts its control and brings clear, settled weather accompanied, in the winter, by frosts. The margin of a 'Low' may develop between two 'Highs' as a trough or tongue stretching to north or south. In the warm months monsoonal conditions are thus occasionally drawn as far south as Tasmania.

CHAPTER XIII

PLANT LIFE

THESE are the broad climatic controls which govern the distribution of plant and animal life in Australia. Rainfall, or rather the lack of it, imposes far more stringent limits on the distribution of the various plant types than are imposed by temperature. However, geographers have long realized that mean annual rainfall is not a sufficient guide to the capacity of an area to support vegetation. The distribution of rainfall throughout the year, the degree to which the rainfall is likely to vary from year to year, and the amount which is evaporated and therefore made unavailable to plants, have all to be taken into consideration.

All the possibilities of using land depend on plant growth; and this, in turn, depends on the extent to which moisture can be retained in the soil. The balance between rainfall and evaporation, as well as the nature of the soil, determine the retention of moisture; and the extent to which moisture is available for plant life is termed 'effective rainfall.' There may, of course, be too little or too much moisture for the best development of any particular form of plant life such as trees or crops.

For most plants that are useful to man, effective rainfall is necessary for a period of at least five successive months.

Using as a test the ratio of precipitation to evaporation, i.e. income in relation to outgo of moisture, the point below which the soil is too dry for the growth of plants is found. Under Australian conditions precipitation must be greater than one-third of evaporation.

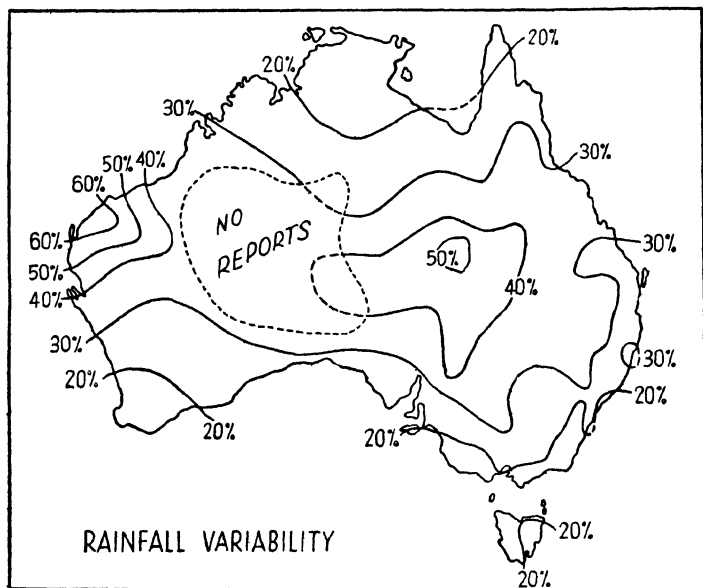


FIG. 50. RAINFALL VARIABILITY

The figures shown on the map are the standard deviation from the mean annual rainfall shown as a percentage of that mean.

The higher the percentage, the less reliable is the rainfall.

The continent can thus be marked off into zones according to the effective rainfall, i.e. for the number of months in which precipitation is greater or less than one-third of evaporation. The result is shown in the table and map on page 121. The large area (34 per cent.) in which no month

has sufficient moisture for plant growth gives the best test of what is desert country, since within this area the vegetation must be specially adapted for making the best use of the brief

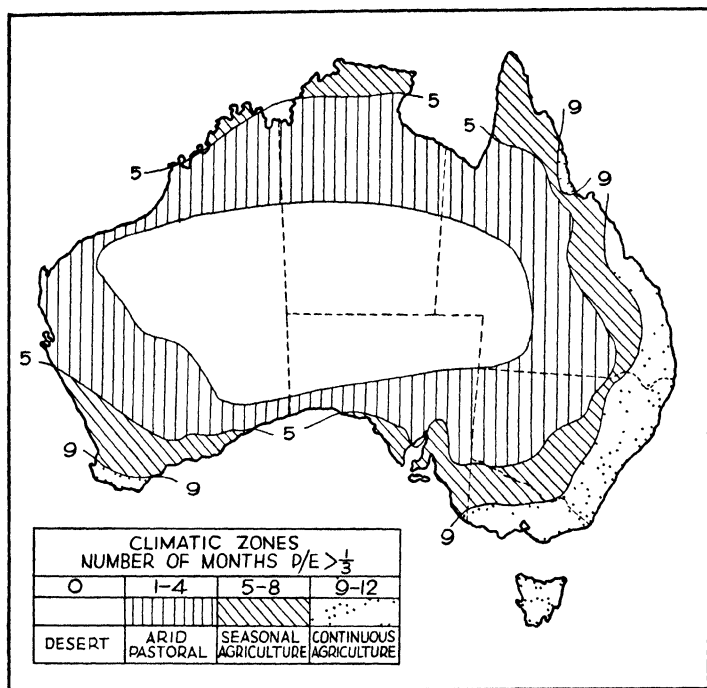


FIG. 51. THE LENGTH OF THE GROWING PERIOD
The map divides Australia into zones according to the number of months of the year in which plants will grow.

periods after rain when the soil moisture is sufficient, and to withstand the intervening periods of drought. The zone with 1-4 months' growing period (42 per cent of Australia) suits pastoral purposes only, 5-8 months' growing period (15 per

cent.) is the zone for seasonal agriculture, and 9-12 months' growing period (9 per cent.) the zone for continuous agriculture. But certain areas within these last two zones, notably in southern Queensland, have no months sufficiently wet to allow the active growth of a crop; they are therefore pastoral rather than agricultural country.

The reader should be cautioned that these divisions refer only to the limits of climate; rocky uplands, poor soil or other circumstances will considerably reduce the usable area within each of the zones where moisture is sufficient for plant life.

1. *Native Vegetation*

The zoning of Australian natural vegetation is more marked from the coast inland than from north to south. The 'tapering' of the rainfall from coast to interior strictly controls the character of the natural vegetation; and, in general, the density and size of plant growth decreases in proportion to the distance from the sea. The chief exception to this arises from the presence of highlands with their normally heavier rainfall. It will be useless to look for the great diversity of plant types that is found in other lands extending, like Australia, from tropical to cool-temperate conditions. The contrast between the evergreens of the tropics and the deciduous trees of the temperate zone is not found here. The plant life belongs mainly to one large family, and the species merely represent types that have become adapted to differing climatic conditions.

Nor is the reason for this far to seek. The continent has been isolated from such early times that those types of plant and animal life which have disappeared in the other continents before the competition of higher types have here been sheltered and enabled to survive. In fauna and flora Australia displays a succession of strange and primitive

types that make the continent a museum of antiquities. This is particularly true of the main family of plants, i.e. the

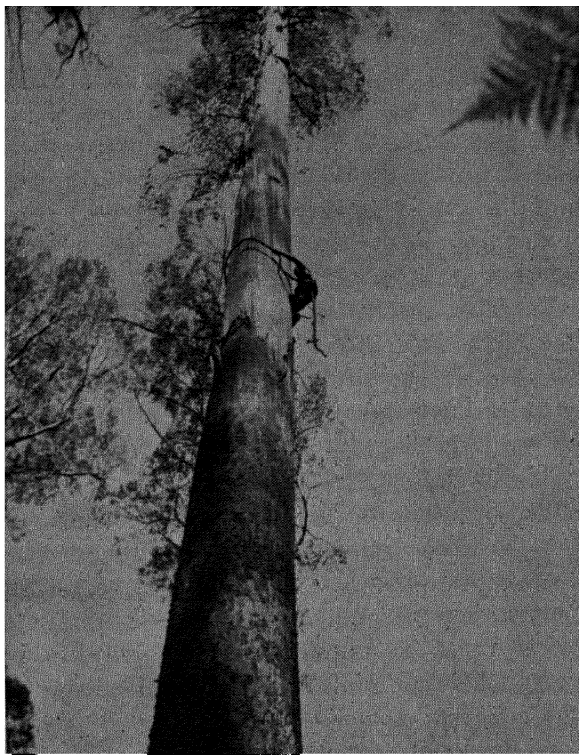


FIG. 52. STEEPLE-JACK OF THE FOREST

Attacking one of the giant trees of the eucalypt forests in the mountain valleys of Victoria. These 'gum trees' vie with the sequoias of California for the title of the world's tallest timbers.

eucalypts or 'gums.' Here we have a great variety within a sameness that embraces the whole continent. The bark,

leaf, and flower systems of the great vegetation types are very similar from Cape York to southern Tasmania. The eucalypt family ranges from the giant swamp gum of the lowlands to the stunted snow gum of the plateaux; from the great gnarled specimens of the inland river valleys to the slender dwarf mallee; from the tall, hard karri of the south-west to the softer species of the mountains; everywhere the gums in endless variety but in apparent sameness form and adorn the typical Australian bush. In density the forests of the continent vary greatly; but they reach their best development in the well watered regions of the south-east and south-west. Another large family, the acacias, or 'wattles,' is also peculiarly adapted to withstand the arid conditions of the desert margins, and ranges from the mulga of the west to the beautiful golden 'wattle' of the south-east and the twisted brigalow of the north. Still farther inland even the acacia gives place to such drought-resisting plants as the saltbush and spinifex.

It will be seen that, for plant life, conditions are much the same over the whole continent, for everywhere except along the east coast there is a long dry season to be endured. In the far north, however, still upon a basis of eucalypts, the true tropical forest, or 'vine-scrub' as it is called in Queensland, occurs wherever rainfall is heavy and reliable enough. Dense thick tree growth, interlaced with a great wealth of creeper and decorated with ferns and parasites, occurs on the rainy seaward slopes. Beyond the coastal region the drier conditions cause a change from tropical forest to the more open savannah in which the trees get fewer and smaller as the true desert is approached. This tapering rainfall is well brought out in figures showing the annual rainfall in inches from Darwin inland to Alice Springs.

The problem of settlement is largely that of converting

bush land into farms. Much of the tree destruction may be useless since it is often found, after clearing, that the area is fitted to produce trees and nothing else. This is particularly the case in the hill sections of the eastern highlands where uncontrolled deforestation has had far-reaching effects, especially upon the flow of streams. The undergrowth and debris of the forest floor acts as a sponge to retain moisture, as a mat to retard evaporation, and as a protective pad against erosion. Forests act as regulators, 'strainers,' and purifiers of the surface water, and allow the water to drain slowly into the channels. When the forest is removed rainfall runs off the surface immediately, taking with it the top-soil by sheet-erosion. The creeks and rivers run 'bankers,' but the channels become choked with the rubbish swept down from the higher levels. Worst of all, the summer-winter balance of the river flow is destroyed, and the streams tend to become dry in the summer.

Wood, in some form or other, is for man a prime necessity; and the further he advances the greater becomes his dependence upon the forests. Timber in the wide range of constructional work, pulp in paper-making, or cellulose for the manufacture of rayon, are every year making heavier and heavier demands upon the forest resources. In the light of these urgent needs Australia cannot be regarded as a well-forested country. A modern community should devote about 5 per cent. of its area to forests: Australia's percentage is less than half of the proportion necessary. The influence of selfish commercial interests and the apathy concerning forest problems, such as the dreadful waste every year through bush fires, is reducing even this proportion by hundreds of thousands of acres each year. The ruin and waste of the past defy description, and the damage in many places can never be repaired. Forestry in Australia is yet in its infancy,

but more serious attention is already being devoted to its urgent problems. The best forests have gone beyond recall, but it is still possible to save much from the wreck by a sustained reafforestation policy.

The serious deficiency of Australian forests is in soft-woods; and an essential part of forest policy in the Commonwealth consists in the planting of trees yielding such timber. Tasmania probably offers the best opportunities for extensive planting with such trees as the Douglas fir and the Baltic pine. Timber of such varieties as these was formerly imported every year into Australia in large quantities. Rapidly increasing demands for forest products in Australia, and especially the increased use of native timber for housing and the manufacture of paper pulp, has made such demands on native forests that the annual cut is already threatening to exceed the annual growth.

2. Introduced Plant Life

Exotic plants have been introduced, and form the basis of fruit culture from pine-apples to pears, and from grapes to walnuts. The smaller berry shrubs form another important branch of the fruit-growing industry in southern Australia. Fruit-growing has now become one of the chief rural industries of the Commonwealth, and falls into four main groups: (i) the stone- and pip-fruits of the deciduous cool-temperate types, e.g. apple, peach, pear, plum; (ii) the fruits of Mediterranean types, especially the citrus fruits and the olive; (iii) the vine, which is so important that it must be considered separately; and (iv) the tropical fruits, such as bananas and pine-apples.

The industry as a whole is of comparatively recent development because of the difficulties of picking and transporting the fruit without damage. Only by improvement in methods and by the use of cold-storage have these difficulties been

overcome. The special incentive to fruit-growing in Australia is the fact that by means of cold-storage it is possible for Australia to get fresh, ripe autumn fruit to Europe at the end of the northern winter. Climate and soil factors in Tasmania and in the hill regions of the south-east and south-

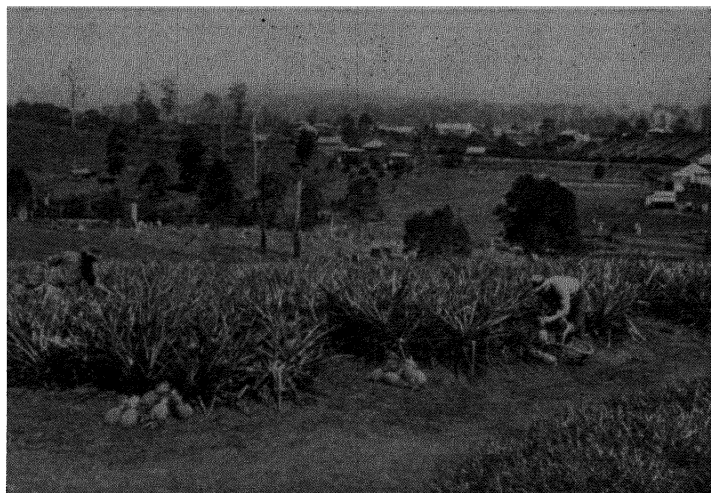


FIG. 53. A pineapple plantation in the Northern Rivers district of New South Wales.

west of the mainland are favourable to the apple, the hardiest of fruits, while the less hardy stone-fruits find suitable conditions where freedom from frost is usual.

Growers of citrus fruits such as the orange find favourable conditions in the warm Murray Valley and adjacent areas. The largest citrus area is found on the inland slopes of New South Wales, but the citrus belt continues along the Murray Valley into South Australia. The vine, too, as would be expected, is largely cultivated in New South Wales, northern Victoria, and South Australia for wine making,

and also in the Murray Valley as the basis of the important dried fruit industry. The tropical fruit districts are found in northern New South Wales and coastal Queensland.

All the cereals grown in Australia, like the fruits, are introduced types. *Wheat* is easily the most important grain



FIG. 54. SEEDING IN THE WIMMERA

The six, eight and twelve-horse teams for long a feature of the Wimmera wheat-growing areas are being ousted by the tractor.

crop, embracing, as it does, about 60 per cent. of the area under cultivation. The area annually sown with wheat (average 13 million acres for the decade 1939-48) is still less than 1 per cent. of the continent. Wheat production is concentrated in the south-east and south-west, since it is there that the climatic conditions most suitable for its growth are found. In parts, wheat is grown with a mean annual

rainfall as high as 40 inches, and in others with a fall as low as 10 inches, but in general the main area of wheat production is found between the 12 and 25 mean annual isohyets. For the 10 years 1939-48 the average annual production of wheat in Australia was about 150 million bushels.

The wheat belt stretches in a great crescent crossing the south-west of the western plateau, passes (after a break north of the Bight) across South Australia, and continues along the inner side of the Eastern Highlands. Thus, the industry is confined to a great plain area that, on its inner margin, approaches aridity. The struggle in Canada to utilize every day of sunshine for the growing of wheat is paralleled here by the attempt to conserve every drop of moisture by keeping the surface soil loose and broken. A new method of wheat-growing, i.e. dry-farming, with summer fallowing, has in fact been evolved to fit these conditions. Sheep are pastured on the fallow land, and to provide water for stock and domestic purposes in Victoria a system of open channels has been laid down which carries the water by gravitation for 250 miles into the Mallee country.

The shortage of labour during the heyday of gold-digging, and the uniformity of surface and climate in the wheat belt, led to the invention of machinery for harvesting the crops. The development from reaper and binder to stripper or header, and so to the harvester which cuts, threshes, and bags the wheat, is largely an Australian contribution. As in other lands where labour has to be spread thinly over vast areas, the machine has saved the situation and has enabled Australia to become one of the world's granaries. Although the production of wheat in Australia is about 3 per cent. of the world's total, the quantity exported represents about 20 per cent. of the total exported from all countries. As an exporting country Australia has made the greatest relative advance

since 1913. Exports from the Commonwealth, including exports as flour, averaged 107 million bushels a year for the period 1935-39.

The methods of cultivation in Australia and Canada differ, and the reason is to be found in the differing rainfall con-



FIG. 55. HARVESTING WHEAT

Typical wheat country in south-western Australia, showing harvesters 'stripping' the grain for bulk delivery.

ditions. In Australia immediately after the first autumn rains (April or May) the seed is sown, and the months of winter rain form the critical growing period. Thus for the south-east the rains from July to September, that is the spring rains, practically determine the yield. A steady increase in the yield per acre is following the spread of better farming-practice and the use of superphosphate. The average yield

per acre in Australia is about $12\frac{1}{2}$ bushels, compared with 10 in Canada and 15 in the Argentine. The relation between Australian and Canadian wheats in the European markets is of interest. The British miller combines the Canadian red wheat, which has relatively high gluten content, with the softer Australian white wheat. Other countries producing similar white wheat are the Argentine, California, and India.

The production of *oats* has been for many years the mainstay of farmers in certain districts. Eleven-twelfths of the crop is used for horse feed. The soil requirements of this crop are not unlike those of wheat. Oats, however, can stand nearly as much heat, and will thrive in wetter and colder conditions. Therefore this grain fits nicely into the climatic conditions of the higher and colder parts of the south-east and especially of Tasmania. Another variation of the production of oats is cropping for hay. This is not confined to oats, for wheat and lucerne are grown for the same purpose. The greatest area under cultivation, excluding wheat, is that used for hay; and a close connection with the dairying industry is to be noted. The storage of green feed, ensilage, is now a well recognized part of Australian farm-practice.

Another crop of some importance is *barley*, which has a remarkable climatic range, flourishing equally well in cool wet Tasmania or on the warmer drier mainland. In the drier areas the 'feed' types are grown, while in the moister regions, especially nearer the coast, the 'malting' types are found. The total exports of malting barley are usually about 2 million bushels, while the local market takes $2\frac{1}{2}$ million bushels for malting also. The best districts for 'malting' barley are in Yorke Peninsula, in South Australia; but good localities are found also in Victoria, Tasmania and Western Australia.

Similar effects of climatic control are to be noted in Australia as in the United States where, moving from cool to hot conditions, the zones of cultivation succeed each other in this order—wheat, maize, tobacco, cotton, sugar. So, too, in Australia there are many places north of the wheat belt with a suitable climate for maize and tobacco. Australia, despite the fact that the cultivation of both plants is of many years' standing, produces too little of either for home requirements. For the greater part maize is grown for fodder rather than for the grain which is absorbed mainly by such industries as starch manufacture. Tobacco culture is in a somewhat similar position. Inferior varieties, unsuitable soils, fungus pest, and wrong methods of cultivation have doubtless proved adverse factors in development, but good progress is now being made.

The cultivation of *cotton* is confined to the state of Queensland. Many attempts were made to establish the industry; but it was not until after the Great War of 1914-18 that, with Government assistance, the industry gained a foothold. The area under cultivation is now about 55,000 acres, producing about 20 million lbs. of unginned cotton per annum. Many difficulties have been encountered, including labour problems and soil troubles.

The hot moist condition of the coastal area of Queensland is also particularly suited to the cultivation of *sugar cane*. Apart from the cereals and forage, sugar is the most important crop grown in Australia; and it is the most important single industry in Queensland. Nowadays, most of the cane is grown on relatively small holdings worked by white labour, and highly intensive methods are in vogue. The cane-fields are to be found on pockets of suitable soil in the river valleys along the coast of Queensland and northern New South Wales. An annual average of 340,000

acres is under cultivation with an average production of about 700,000 tons. The introduction of a home price for sugar has enabled the payment of a bounty on sugar exports. At present approximately half the sugar crop is exported; but further expansion of production is limited by a system of land assignments. A series of experimental stations is performing excellent service in the development of the industry by demonstrating better methods of cultivation, coping with the problems of individual growers, and distributing improved varieties of cane.

CHAPTER XIV ANIMAL LIFE

1. *Native Animal Life*

THE nature of the trees, plants, and grasses determines, to some extent at least, the character of the native animals and also the type of animal which man can introduce with advantage. The distribution of the animals introduced into Australia by the settlers will be considered presently in relation to climate and plant life. The native animals have, of course, an even closer dependence upon the original vegetation; and they include types unknown in other lands. They represent even more strikingly than do the native plants the survival of primitive forms which were protected by the isolation of the continent from competition against animals of a higher order. Scientists, and especially biologists, find in their structure and habits important phases in the evolution of animal life.

The native animals peculiar to Australia fall into two main groups: (i) the Egg-laying Mammals or Monotremes, the most primitive of all animals, represented by the duck-billed

platypus and the spiny ant-eater; (ii) the Marsupials or pouched animals, represented by types that have adapted themselves to such widely differing habits of life as those of the kangaroo, the phalanger or 'opossum,' the wombat, and the bandicoot. All these are commonly found throughout the continent with local variations of size and colour. So peculiar is the animal life that much speculation has arisen concerning the origin of the dingo or wild dog, an isolated case of an animal belonging to a higher order which almost certainly came to the continent with the aboriginal.

The bird life of Australia is also quite distinctive if not unique. Parrots and shrikes are found everywhere, but are paralleled by similar types in other countries. The kingfisher or laughing jackass and the magpie are common and characteristic. Others deserving mention are the emu, a flightless bird about the size of an ostrich, the cassowary, a somewhat similar type found in the north, and the black swan. Mention must also be made of the mutton bird, a curious migratory petrel whose habit of returning year after year to the same islands of the south-east has led to the peculiar industry of preserving the birds in brine, chiefly for the Maoris of New Zealand, who consider them a great delicacy.

2. *Flocks and Herds*

As settlement extended native life tended to disappear before the competition of imported animals. The first European settlers found 'Stone-age' Man actually living as he must have lived thousands of years before in Europe. Scientists have for years been studying the life and customs of the Australian aborigines ere they disappear before western civilization as did the aborigines of Tasmania. The stone-age men of Arnhem Land and New Guinea soon became accustomed during the war to the sight of aeroplanes

and other advanced machines, to all the savagery of 'civilization' in fact; and the effects upon native life cannot but be most disturbing.

All native life, even the fish, seems to be in danger of extinction by other animals or by man himself. Several exotic animals have become pests. The rabbit (or Belgian hare) was introduced by sportsmen, but became so prolific and widespread that both the kangaroo and the sheep had to retire in many areas. Optimistic but fruitless efforts have been made to confine its ravages by countless miles of wire-netting. However, the rabbit has become an asset as the basis of a big felt and fur industry, and during the war was an important item of food. The starling, which came to combat orchard pests, remained to prey on the fruit. The blackberry introduced by garden enthusiasts now threatens the farms and fern gullies of the south-east. The alien prickly-pear cactus was claiming half a million acres of land per year until the caterpillar of the moth *Cactoblastis cactorum* effectively destroyed it and restored 6,000,000 acres to use. Even the camel, introduced for transport service in the dry lands, the donkey, and the Indian buffalo taken to the north as a farm animal, have run wild.

Australia is, in general, far more dependent upon its flocks and herds than upon its vegetable crops. The net value of production dependent upon grass is about 35 per cent of all production, and pastoral exports 60 per cent of all exports. Sheep breeding for the production of wool is the greatest rural industry, although dairy farming and cattle raising are also of considerable importance. Here again the main control is that of rainfall. As the rainfall gradually diminishes towards the interior, agriculture and mixed farming give way to the sheep. The 10-inch rainfall line marks the approximate boundary of the pastoral areas

in the great interior plains. North of that, except on the Barkly Tableland, the sheep disappear, and are replaced by cattle which thrive in the hotter, moister conditions and on the harsher grasses of the north.

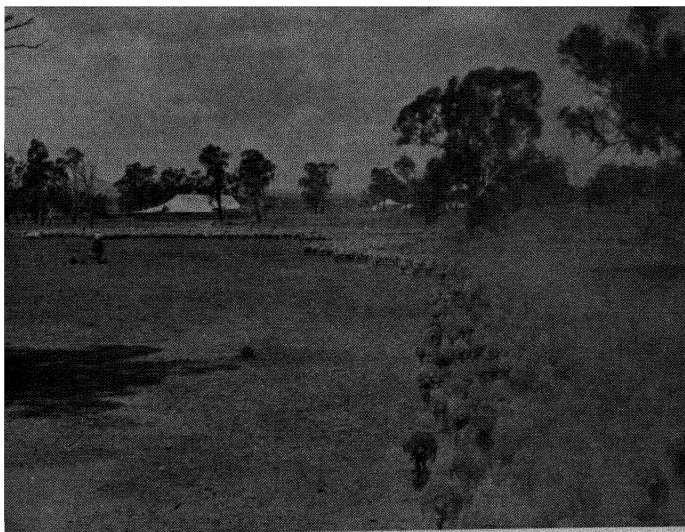


FIG. 56. MUSTERING SHEEP

A dusty, thirsty job, mustering sheep for shearing at a station in New South Wales. Shearing begins about August in Queensland but is later in the southern States. Teams of shearers move from station to station, and the homestead becomes a scene of great activity until the wool is shorn, classed, baled and sent off to auction.

Life on an inland sheep station or cattle run is a lonely business. Since vegetation is sparse, each animal requires several acres, and vast areas are necessary for the sheep that are pastured. The prized fine wool is largely a result of the efforts the sheep must make to survive. In Australia, the

total number of sheep carried is about 120 million, representing one-sixth of the world's flocks. The population engaged in sheep and cattle raising is widely scattered. Although about one-third of Australia's sheep are carried on wheat farms, most of the remainder are to be found on the large runs of the interior. The 'boundary rider' must cover hundreds of square miles in the performance of his duty; and, under the difficult conditions of an arid climate, he requires great skill and patience to keep the stock in good condition. Droughts mean enormous losses to the station owners of Australia and affect the general prosperity of the country very deeply.

Australian wool is mainly of the fine merino type, and buyers gather from all over the world to bid for the clip, of which about 90 per cent. is exported. Wool sales are conducted in the season at the capital cities and also at Geelong and Launceston. The chief buyers since the war represent Great Britain, U.S.A., France, Belgium and U.S.S.R. An increasing proportion of the clip is being used in local textile manufacture.

The sheep industry also provides mutton and lamb for home consumption and export. In 1939 Australia supplied lamb and mutton to the value of 30 per cent. of the British import of such meat; but the contribution became less stable after 1945.

Although the cattle industry is not as important as that of sheep raising, there are over 13 millions of cattle in Australia which are the basis of the dairying and beef industries. In the hotter and wetter conditions of the north, and in the areas with more than 20 inches of rain, roam the cattle that are the basis of the beef trade. The development of the export trade in butter led to a great expansion of dairy herds, and these are found mainly in a well-watered

temperate belt, 100 to 200 miles wide, along the east and south-east coast. In 1939-40 butter to the value of £A17 millions and beef to the value of £A2·5 millions was exported, mostly to Great Britain, but both are now declining.

Conditions over large areas are suitable for horse-raising;

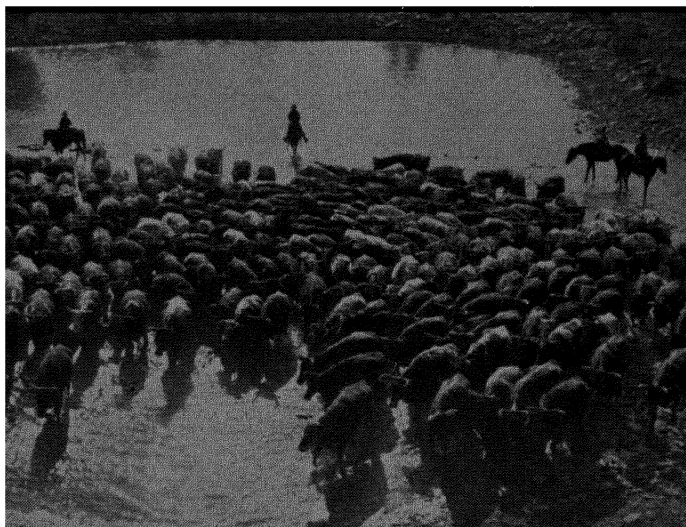


FIG. 57. 'DROVING' CATTLE, NORTHERN AUSTRALIA

Overland routes are determined by supplies of water. Cattle at a waterhole on the way to the coast.

but it has declined somewhat from its former great importance owing to the competition of motor traction. It is estimated that nearly two million horses are maintained; but, owing to the mechanization of the modern army, the export of horses for military purposes has greatly declined. Closely connected with the development of dairying is the industry of pig-raising. About one million animals are maintained.

3. *Water Supply*

The dependence of the pastoral industry in central Australia upon supplies of water is so close that the securing of water supplies is the first need for expansion. This water may be subterranean or on the surface, and reference has already been made to the storing and distribution of water in the dry parts of the south-east. A more remarkable system is that of the central plain and of other small basins where boring for subterranean water is carried on. These artesian bores will be examined more closely in a later section.

Irrigation is confined almost entirely to the south-east, or even more strictly still, to the Murray-Darling Basin, which is almost the only area with sufficient surface water for irrigation purposes. The earlier schemes for using the Murray waters were small and restricted in their scope; but the rights of people living farther down the valley were threatened by later schemes for storing the waters of the Murray and its tributaries. Moreover, the river forms a highway, and the issue of 'Irrigation or Navigation' had to be faced. Ultimately a compromise was effected, by which the States concerned controlled the water in the general interest through the Murray River Commission. The locks were made navigable for river craft as far as Echuca.

The two great difficulties to be overcome were the irregular nature of the stream flow, and the deltaic character of the river with its many side-channels. In general, the supply of water is deficient for the demands likely to be made on it; but against that has to be placed the undoubted fertility of the soil, which has been proved in irrigation colonies at Mildura, Renmark, and other places. Another large irrigation scheme has been established on the Murrumbidgee. In the Leeton-Griffith area enough rice is grown to supply

the Commonwealth, as well as citrus fruits. The Murray irrigation areas grow citrus and other fruits, and are also the home of the dried-fruit industry in Australia.

The other method of increasing water supplies is by boring in artesian basins, of which the Great Artesian Basin

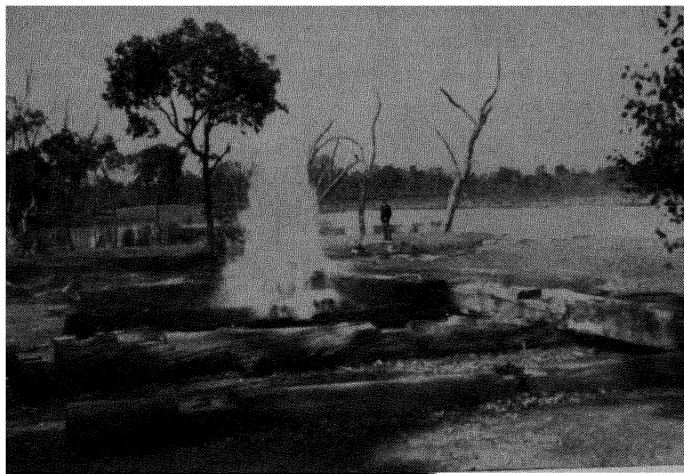


FIG. 58. Artesian Bore, Western Queensland.

stretching from the Gulf country to the Murrumbidgee is the largest known anywhere. This vast area receives, in general, less than 10 inches of rain a year, and the sinking of bores to tap the subterranean waters has become an important part of development. Large variations occur both in the quality and quantity of the flow from these bores. Much of the water is so salt that it is useless for irrigation because of the alkaline deposits left on the surface by evaporation.

The artesian water supplies of the Great Basin have become of prime importance to the sheep and cattle lands of

Queensland, where nearly 7,000 artesian and sub-artesian bores supply 250 million gallons of water daily. In other artesian basins another 1,000 bores have been sunk, but with varying success. One important result of artesian supplies has been to increase the carrying capacity of the land and to make small holdings possible. Present methods of exploiting the subterranean reservoirs are, however, very wasteful, and action is now being taken to limit the flow to actual requirements because of the alarming decrease in the volume.

CHAPTER XV

POPULATION AND SETTLEMENT

IT has now been shown how rainfall—its amount, distribution throughout the year, and the variability in fall from year to year—determines the distribution of the primary industries. In the areas of high and reliable rainfall we find the forests and such industries as sugar cane growing and dairying. Further inland, there are the mixed farming and wheat belts, while in the interior we have the large sheep stations, with the population gradually thinning out as the desert is approached. In the north, the grazing of beef cattle is carried out on huge runs sometimes stretching for hundreds of miles.

If the map showing distribution of population is examined it will be seen that the pattern of settlement has likewise been decided by the control exercised by the climate on vegetation growth. The history of settlement shows, further, that as development proceeds, population tends to cluster rather than to spread. In Griffith Taylor's words, 'the millions of the future will be settled precisely in the regions where the

millions of to-day are found.' The only exceptions to the rigid limitation of settlement by rainfall are provided by the artesian areas, in which no great density can ever be expected, and in the mining areas such as Broken Hill and Kalgoorlie, where the presence of rich mineral deposits has attracted settlements of a temporary nature. The achievements in water supply and other amenities in these desert settlements are truly remarkable, especially so at Broken Hill.

Two other aspects of Australian population may be mentioned, viz., concentration and composition. Even if the existing population were scattered evenly over the surface, if that were possible, it would be spread very thinly, since each inhabitant would have about half a square mile of country. Although it has been shown that Australian prosperity is largely dependent upon rural industries, only about one-third of the people live in the country proper. The actual figures are these: In capital cities, 47 per cent.; in provincial towns, 17 per cent.; in country areas, excluding towns, 36 per cent. Efforts have been made to settle greater numbers in the wheat, fruit and dairying areas; but the greatest single problem of settlement is presented by the empty north. In 1935, for over a million square miles of tropical Australia there were 193,000 people, and 96 per cent. of these lived in tropical Queensland, mainly along the coast. There is, then, a great stretch of territory in northern Australia in which settlement is extremely sparse. The reasons for this are both physical and economic. The climate presents handicaps to agriculture and, along the coast, to human comfort; the soils are patchy; and the isolation of the area from the more densely settled parts of the continent hinders the transport of goods and persons. Not justly can the failure to develop the 'empty spaces' of the north and centre be attributed to a lack of enterprise on the part

of the Australian people. The reasons are to be found in the conditions of effective rainfall for plant growth. Despite the appearance of great productivity achieved in parts under circumstances of military occupation, and despite, too, the

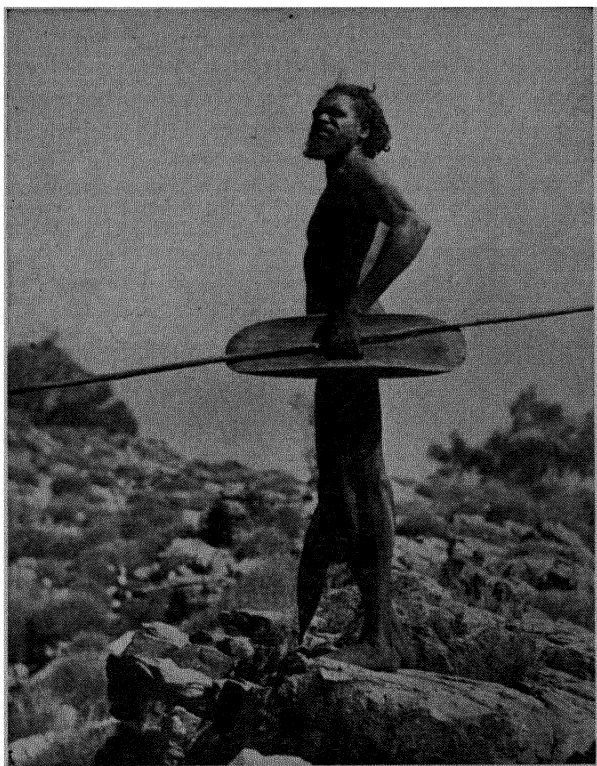


FIG. 59. NOBLE NOMAD

An Australian aborigine, one of a race which
is fast dying out.

enconiums paid by unscientific visitors to its great possibilities, the test of effective rainfall marks the country

as extremely difficult for permanent agriculture except in limited areas.

The second aspect, composition, bears to some extent on settlement. The people of Australia have decided that the mixture of different races, religions, and cultures presents problems that are better avoided; and permanent immigration is, therefore, limited to white races. Excluding the aborigines, 99 per cent. of the population belongs to the white group, while over 90 per cent is of British descent.

Note.—The name Australia apparently comes from a work by a South American lawyer, Dr. Arias, who wrote of a speculative *Terra Australis* (1620). John Dunton, a London bookseller, first used the word "Australia" (1693), and Alexander Dalrymple, a contemporary of Captain Cook's, gave it general use.

CHAPTER XVI

ECONOMIC SURVEY OF THE NORTH AND EAST

AS settlement proceeded in Australia the continent was divided into colonies (since called States) by purely arbitrary lines that in no way coincide with the boundaries of the natural regions. Such artificial divisions now hinder any attempt to get an accurate view of the facts of primary and secondary industry. For our purpose, therefore, the boundaries between the States will be disregarded. The great natural regions into which Australia falls have been discussed, and the remainder of our study will be an extension along the lines already laid down. We may conveniently distinguish the following areas: (1) North and Central Australia; (2) the Great Artesian Basin; (3) Coastal Queensland; (4) the 'Northern Rivers'-Darling Downs Region; (5) the South-east; (6) Tasmania; (7) the Murray-Darling Basin; (8) the South Australian Highlands and Rift Valley; (9) the West and South-west.

1. *North Australia and Central Australia*

These areas comprise the Northern Territory and the northern section of the State of Western Australia. That part of northern Australia which is part of Queensland is

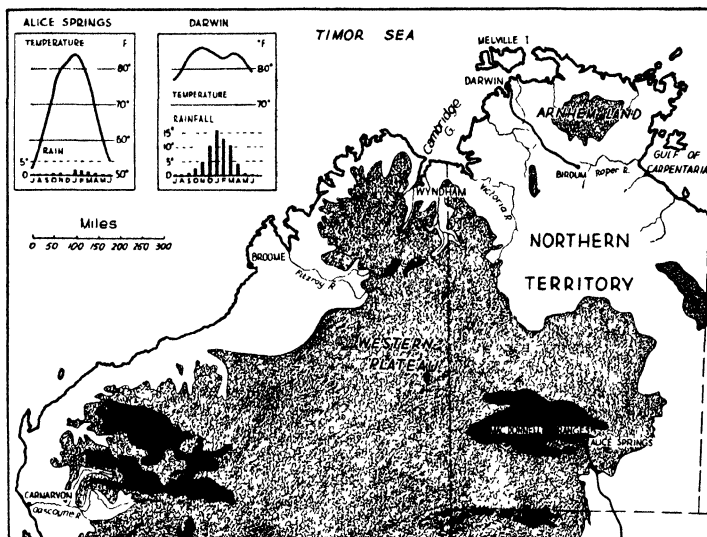


FIG. 60. North, North-west and Central Australia.

discussed later. In contrast to Queensland, more particularly coastal Queensland, 'The Territory' as it is called is very sparsely populated. Its development forms one of the most difficult problems facing the Australian people, since they have decided that settlement in the continent must not be done by exploiting the labour of non-whites. Climatically it is an extremely difficult region for Europeans; but a distinction must be drawn between the low-lying, mangrove-fringed coastal areas which offer the maximum of discomfort, and

the higher back country. North Australia is not a region of steaming forest lands like much of Malaysia. Less than 20 per cent. lying near the coast is of this type, while the higher interior for the greater part of the year has a healthier



FIG. 61. Pandanus forest, Wildman River, Northern Territory.

climate. Thus the areas more suited to human health and comfort are inland; but there, unfortunately, the rainfall is inadequate for agriculture.

The following description of the climate of the region may give a more vivid idea of the problem it presents to settlers.

'The different changes of the seasons are so uniform and regular that they may be predicted almost to a day. Signs of the approach of the wet season appear in September, when the strong E.S.E. monsoon—which has been blowing continually throughout the dry season—ceases, and is succeeded by calms, and light variable winds;

the weather becomes intensely hot, and small thunder-clouds gather over the land, increasing in size and density day by day until they burst into terrific thunderstorms, accompanied by hurricane squalls of wind and rain. These squalls increase until the end of November, when they occur almost daily. They come up in a dense black bank, and travel so very rapidly that they are generally out of sight on the western horizon within 40 minutes.

'During December the N.W. monsoon gradually gains the ascendancy. The thunderstorms disappear, the sky becomes overcast and clouded, and the atmosphere gets thoroughly saturated with moisture—so much so that leather-work becomes green with mildew if not constantly attended to; the binding of books becomes soft; and sugar or salt, if exposed in an open vessel, will soon liquefy. Even this is felt to be an agreeable change after the intensely hot weather during the change of the monsoon in October and November.

'The N.W. monsoon is accompanied by rain almost daily, and increases in force until the latter end of January or beginning of February, and penetrates with its copious and fertilizing showers into the very centre of Australia. The maximum temperature in the shade during the day in this weather is 96°, and the minimum during the night is 65°.

'On the approach of the autumn equinox the N.W. monsoon gradually dies away, and is succeeded by calms, variable winds, thunderstorms, and oppressive weather until the end of April, when cooler weather is felt; the S.E. monsoon sets in, and the dry season may be said to have fairly commenced. The wind is characterized by a clear sky, enjoyable weather, heavy dews, and cold mornings and nights—so cold that blankets can be used. It blows off the coast without intermission, and with great force, almost throughout the season, being in full heat between June and July.¹

This seasonal distribution of rainfall results in a true pastoral region comprising great stretches of 'savannah' country. Sheep, except in the cooler Barkly Tableland, are unable to thrive in the monsoonal conditions, but Northern Australia is now becoming the chief cattle-raising region. Further, over the greater part of the area the soils

1. Adapted from a description quoted by Griffith Taylor in *The Australian Environment*.

are poor, but patches of higher fertility exist, and on these successful experiments have been made in growing rice, cotton, peanuts, millet, tomatoes, and other crops.

Other great drawbacks to the development of tropical agriculture are the lack of labour and transport. Native



FIG. 62. A Station Homestead in the Kimberleys,
Western Australia.

labour, with the assistance of which other tropical lands have been developed, cannot be depended on in Australia. The aborigines, of whom there are estimated to be about 30,000 in the north and north-west, are nomadic tribes mainly engaged in hunting. They know nothing of agriculture, and experience great difficulty in adapting themselves to any settled occupation. A comparative few, however, are employed in connection with the cattle industry under white

supervision. With education, care and proper understanding the aborigine could doubtless be given a much better place in the development of the north than he now occupies.

The comparative absence of tropical diseases of the malarial type is one hopeful aspect for settlement. The

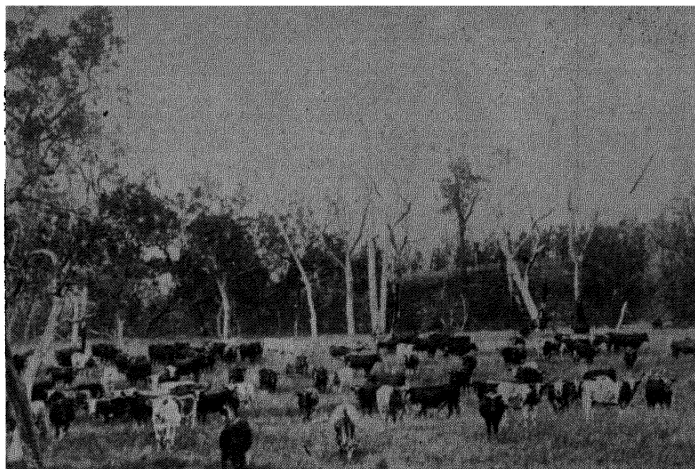


FIG. 63. BEEF CATTLE, NORTHERN AUSTRALIA

Beef cattle grazing is the great industry of the tropical grasslands in Northern Australia.

population of the Northern Territory before the war was estimated to be about 6,000, most of whom are engaged in the cattle industry or in government services. The pearl fishing industry centred on Broome was suffering a decline in recent years; but there has been an increase in the production of minerals of various types.

Darwin is the administrative centre for the Northern Territory, but its progress as a port has been slow owing to the undeveloped hinterland and the infrequent steamer

services. It is the point of connection between the overland telegraph, the rail, the road, and the cable, and in recent years has been developed as an airport. As a result of war-time developments Darwin is destined to fill a far more important role than it played in the past. Under the 1949 agreement between the British and Australian governments, to expand the beef industry, *Wyndham* will become an important centre. Meatworks were built there, but for various reasons the industry failed to thrive and these are now closed. *Alice Springs*, in central Australia, marks the northern terminus of the railway from Adelaide, and the beginning of the road to Darwin.

2. *The Great Artesian Basin*

This region varies greatly in both rainfall and fertility. The eastern half, with the better rainfall, carries that alternating grass and bush land that marks the ideal cattle country. This savannah vegetation shades off in the south-west towards Lake Eyre, where conditions are so dry as to support only comparatively few cattle. This great basin is one of the most extensive areas of inland drainage in the world. Lake Eyre, nearly 40 feet below sea-level, is a vast, salt-encrusted flat holding a few inches of water only after heavy rains. Neighbouring Lake Torrens, stretching for 150 miles to the south, is a similar area. The brigalow, a species of acacia, is the chief shrub for large stretches of the inland plains. Gums occur most thickly along the Eastern Divide and in the water-courses. An outlier of the western plateau—Barkly Tableland—lies to the south of the Gulf of Carpentaria, and is the most promising area for pastoral development in the region. North of this the land slopes away gradually to the mangrove swamps fringing the shallow Gulf. One of the problems of the region is the difficulty of

access from the north, only one port—Normanton—presenting any possibilities at all.

Much of what has been said concerning the Northern Territory applies also to this region. Allowing for the

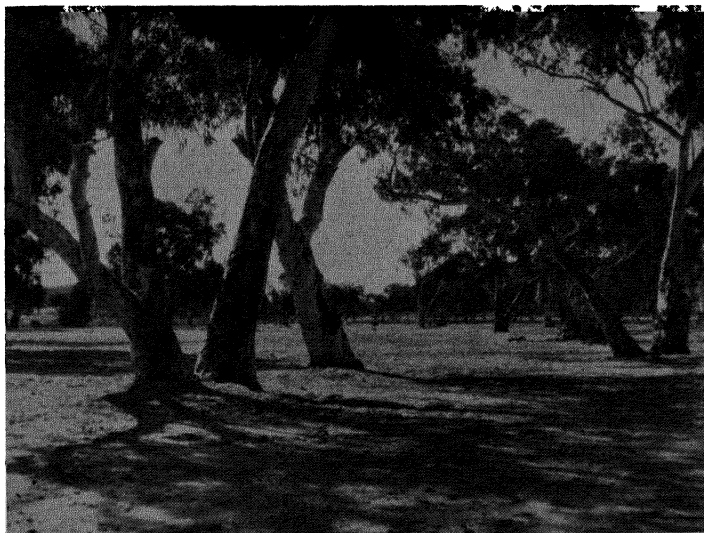


FIG. 64. ARID BEAUTY, TODD RIVER

Eucalypts (Red Gums) along a dry water-course in South Australia. The strength of the current in the wet season is indicated by the quantities of sand deposited in the bed of the stream.

tapering of the rainfall towards the interior, seasonal changes are very similar; but the range of temperature is greater inland. Only the presence of the artesian water makes it possible for the cattle stations to carry their stock through the long 'dry season.'

Communications have developed by means of spur-line railways from the eastern ports to the pastoral interior. The

most northerly of these runs from Townsville across the ranges to *Hughenden*, an important pastoral centre. The line continues thence to *Cloncurry*, a copper-mining area, on the edge of the Barkly Tableland. Other lines run back from

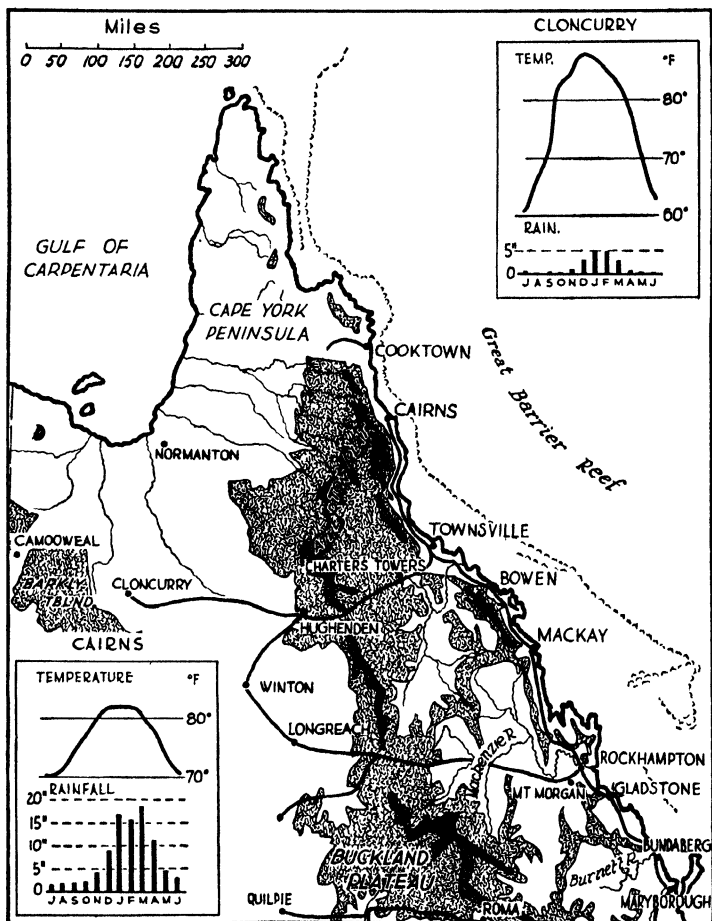


FIG. 65. NORTH-EASTERN AUSTRALIA

Rockhampton, to *Longreach*, and from *Brisbane* through the Darling Downs to *Quilpie*, almost on the edge of the Lake Eyre Basin. An important project is to link up the eastern States to Darwin by a line from Bourke in New South Wales via Camooweal. The great inland areas in this region receiving 15 inches or more of rain a year contribute largely to the prosperity of Queensland.

3. *Coastal Queensland*

The main feature of this region is the narrow strip of country between the highlands and the Pacific. The highest land of this section of the Divide rises almost abruptly from the sea. This is the Bellenden Ker range, the coastal battlement of the Atherton plateau, in which the highest peak, Mount Bartle Frere, rises only to 5,500 feet. Since this upland opposes the prevailing on-shore winds, it is not surprising to find that the highest rainfall in Australia occurs hereabouts. A very large area receives over 50 inches of rain a year, while some localities receive over 160 inches. This led Griffith Taylor to regard it as 'the most favourable region for close white settlement in northern Australia,' a prophecy which has been fulfilled in a remarkable manner. If efficient rotation of crops and soil conservation were practised more widely the fulfilment would be even more striking.

The height of land in general lies much farther back from the coast than this, however, and the divide behind Rockhampton is 300 miles from the sea. The highland region is a broad belt of range country which narrows to the north and south, but makes communication between the seaboard and the interior a matter of some difficulty.

In the wetter uplands, dairying has become an important industry, although some parts are little more than 1,000 miles south of the equator. The great staple of the region

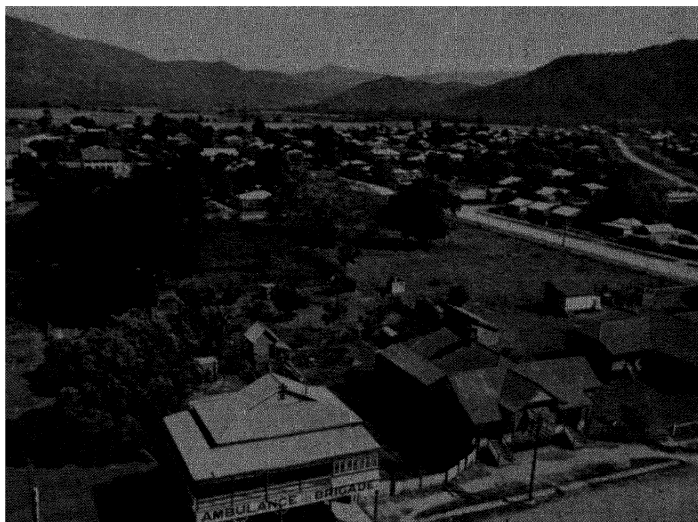


FIG. 66. A SUGAR TOWN, COASTAL QUEENSLAND
Sugar growing is the main industry in the valleys of Queensland's east coast. Queensland can show the success of the greatest experiment in white settlement in the Tropics.

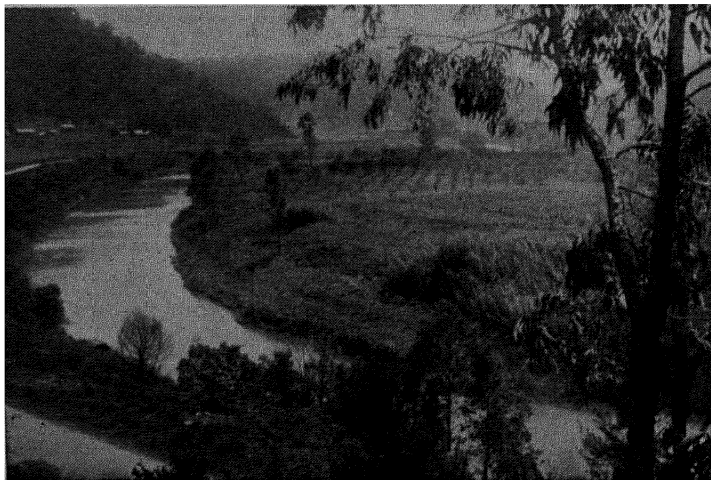


FIG. 67. Maroochy River, South Queensland.

is sugar; and, as rainfall is sufficient or can be supplemented by irrigation almost everywhere along this coastal ribbon, each river valley has become a cane-growing area. A feature of development before the war was the influx of Italian settlers to the more tropical far north between *Mackay* and *Cairns*. Sugar growing and dairying, together with cotton growing and mining, are the main support of the 300,000 whites who live in the coastal belt north of the Tropics. This constitutes the most successful attempt at tropical settlement by the white race in the world. In addition to sugar growing, the cultivation of bananas has become an industry of some importance. *Mackay* is the chief centre for sugar refining and export, but *Bundaberg* and *Maryborough* are also of consequence in this industry. The broad Fitzroy valley, a splendid grazing area, opens out to *Rockhampton* on the coast, the chief port and commercial city of central Queensland. Many minor irrigation schemes for sugar growing have been introduced along the coast, but the most important is near *Ayr* on the delta of the Burdekin River.

The highland region has always been noted for its rich mineral deposits, although its production of gold and copper is no longer as great as in former years. The glory of *Mt. Morgan* has departed, but rich fields exist elsewhere. Behind *Cairns* is the Chillagoe field noted for its tin and copper. *Townsville* is the outlet for the gold-mining area around *Charters Towers*, while *Maryborough* is the port for other mining areas around *Gympie*. Coal of good quality is worked at *Ipswich*, *Bowen* and at *Blair Athol* development is planned. Total output is, however, only about one-sixth of that of the Northern District coal-mines of New South Wales. This mountain region is also important for the possibilities it offers for the production of hydro-electric power from the vigorous rivers all along the seaboard.

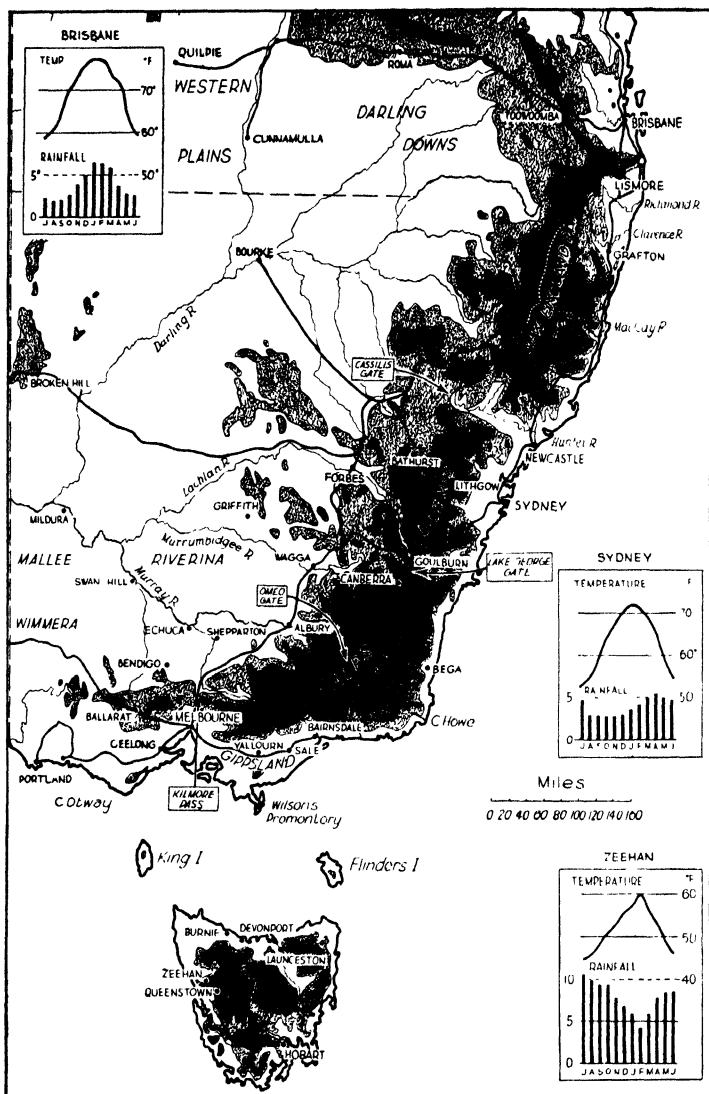


FIG. 68. Eastern and South-eastern Australia.

4. *Darling Downs-'Northern Rivers' Region*

This area is in many respects a southern continuation of the two divisions just described. The main divide curves towards the ocean from the Buckland Tableland, 300 miles inland from Maryborough, to within 20 miles of the coast in the New England plateau, enclosing in this sweep the Darling Downs. The New England plateau is the largest mountain block in Australia, and although it is not the highest, it rises to 5,000 feet in Ben Lomond. As in north Queensland, where the highlands stand close to the ocean, heavy coastal rainfall is the rule. Nearly the whole region receives more than 10 inches of rain, and the coastal portion receives from 40 to 60 inches. The well-watered uplands are notable for extensive forests of gums and softwoods, which thin out towards the plains. The drier conditions to the west are responsible for the concentration on sheep-raising as the main industry. Between the plains and the plateau, however, is a considerable piedmont area devoted to mixed farming. The coastal strip passes from the sugar belt which ends about Grafton into the splendid dairy farming country lying in the valleys of the 'Northern Rivers', as they are called.

Though not usually included in this group of rivers, the Brisbane is the most important, since it has become the southern gateway of Queensland and the entrance to the metropolis of the State. *Brisbane* (300,000), the State capital, lies a little inland from the coast, and the river fairway is maintained by dredging. By its situation the city commands the route to Ipswich, a coal-mining area, and to the productive Darling Downs district. The chief inland centre is *Toowoomba*, the capital of the Downs country, with over 26,000 people. South of Brisbane, the Tweed, Richmond, Clarence and Macleay Rivers have scooped from the plateau the valleys that form the chief areas of production.

Sugar-cane growing has largely given place to dairying, although *Grafton* still owes its importance largely to sugar. Bananas have also become an important commercial crop in this district. *Lismore* is another thriving commercial centre on the coastal belt. It is worth noticing that the main railway to the north climbs to the plateau nearly 3,000 feet above the sea to pass through *Tamworth*, *Armidale*, *Tenterfield* and *Warwick*, farming centres of 5,000 to 7,000 people. *Tenterfield*, which was formerly an important tin-mining centre, has given way to *Tingha* and *Emmaville*, centres for the production of a small volume of this mineral.

At the extreme south of this region occurs a wide fertile valley carved out from the surrounding highlands by the Hunter River. At the head of the valley is the pass which forms one of the most important gateways to the Pacific Ocean, from the great pastoral areas of the interior. The valley itself is the seat of many successful primary industries, from dairy farming to vine growing, and from saw-milling to lucerne growing, all of which depend upon the rich soils resulting from basalt flows of past ages.

The Hunter Valley has, however, become of the greatest economic importance for other reasons than these. About 200 million years ago great forests grew in this area; they were later submerged and buried under masses of silt carried down to the sea-bed, and became in time the highly important coal measures of the district. These occur in three great series, the Upper or Newcastle, the Middle or East Maitland, and the Lower or Greta measures. Of these, the last is now extremely important, since Greta or Maitland coal is the best for gas-making or fuel. Sixty per cent. of the immediately workable reserves of Australian coal lie in this valley, and from these mines coal for gas, railways and domestic purposes is shipped to all the southern states.

Overseas export, which was previously important, has greatly declined in recent years. *Newcastle* at the seaward end of the valley has become not only a very busy coal port, but also the great centre in Australia for the heavy industries dependent on coal, such as the making of steel, galvanized iron and wire, shipbuilding and engineering, and the making of cement. Other dense centres of mining population occur up the valley, including *Cessnock* on the South Maitland field.

CHAPTER XVII

ECONOMIC SURVEY OF THE SOUTH-EAST AND SOUTH-WEST

1. *The South-East*

THIS region comprises the highland masses of the eastern system, and the coastal area of varying width between them and the sea. This mountain section is, in general, narrower than it becomes farther to the north; and it falls into a series of massive blocks of which the Blue Mountains and the Kosciusko Plateau are the most notable. These masses are separated by depressions that form the gateways from the coast to the interior. The Blue Mountain Plateau, a great, hard, sandstone block, falls away sharply on the seaward face, and is dissected by the coastal rivers into a series of remarkable canyons and gorges that are features of the rugged scenery in this region. Between this block and the complex south-eastern 'knot,' and at an elevation of 2,000 feet, occurs the important Lake George Gap through which the main route to the south-west taken by the Sydney-Melbourne railway passes.

South of this gateway are three blocks separated by deep gorges and culminating in summits that are the highest in Australia, viz. Kosciusko (over 7,000 feet), Bogong, Feathertop and Hotham (all over 6,000 feet). Connecting

the gorges of the Tambo and Mitta Rivers is the Omeo Gap lying at an elevation of 3,000 feet. This region of 'humps' is known as the Australian Alps, yet they are not truly Alpine

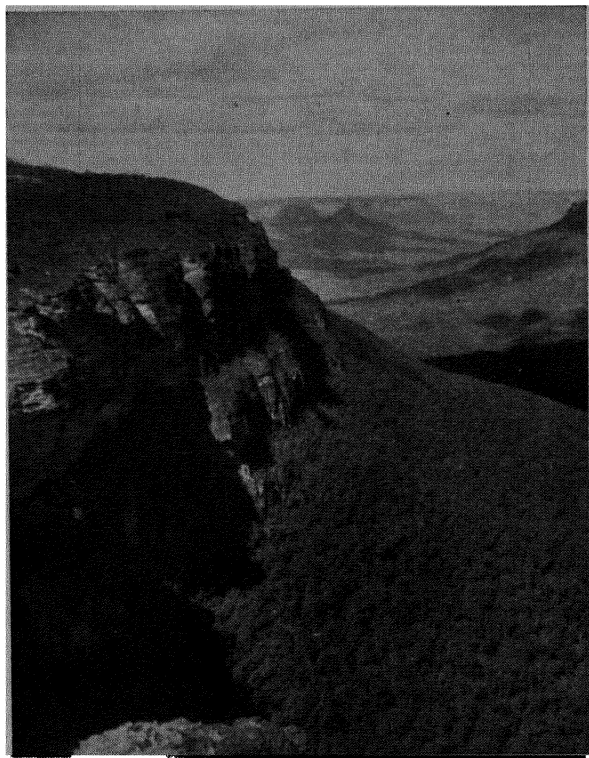


FIG. 69. The Blue Mountains, New South Wales.

in character, despite the occurrence of snow fields and bare rock faces. Although the ravages of fire and axe are rapidly diminishing their extent, some of the finest forest areas occur in this corner. Westward of the Alps the cordillera diminishes in mass and falls away to the Kilmore Gap north of Melbourne, the main gateway from the south lying at an

elevation of 1,200 feet. Further west, the summits of the Grampians rise to well over 3,000 feet. Towards Cape Otway and Wilson's Promontory there are other high regions that mark the southern edge of the east-west valley of Victoria which is bisected by the 'sunkland' of Port Phillip.

The district between the Blue Mountains and the sea is somewhat barren because of the control exercised by the prevailing sandstone. Beneath this area lies the saucer-like formation of the coal measures, reaching the surface in a wide sweep from Newcastle in the north to Lithgow in the west and Bulli in the south. Farther to the south better soils and good rainfall are the factors responsible for the main industry of dairying. The great valley of Victoria consists of the district of Gippsland, varying widely in fertility, and the Western District which has been rendered fertile, in parts, by the soils resulting from great basalt flows in ancient times. Both east and west of Port Phillip the valley is the seat of important rural industries such as dairying, sheep-raising, fruit-growing and agriculture of many kinds from wheat to maize and from potatoes and onions to sugar beet.

COAL RESERVES OF AUSTRALIA BY STATES

(Millions of tons, approximately)

<i>State</i>	<i>Anthracite and Bituminous</i>	<i>Sub-bituminous and Lignite</i>	<i>Ann. Prod.</i>
N. S. Wales	11,718	—	11
Victoria	34	37,000	5.3*
Queensland	1,704	70	1 7
S. Australia	—	600	04
W. Australia.	—	800	.56
Tasmania	244	—	.14
Total	13,700	38,470	18.74

*Includes 5.0 m. tons brown coal.

This table shows the extent to which Australian industries depend on New South Wales coal for industrial power.

Owing to the temperate climate and the great productivity of the south-east, most of the population is concentrated

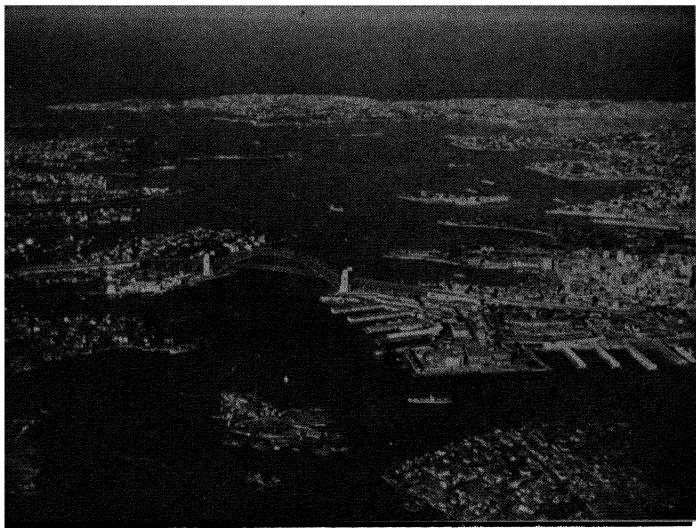


FIG. 70. AN AERIAL VIEW OF SYDNEY HARBOUR

Sydney's magnificent harbour, formed by the drowning of a river valley. Note the great span of the bridge linking the north and south shores.

in the coastal area. *Sydney*, the State capital and largest Australian metropolis, contains one and a half million people. It is notable as the main outlet for the produce of New South Wales. It became important in the first place as the centre of administration, and was later consolidated by the convergence of railway lines from north, south and west on Port Jackson. Almost the whole of Australia's trade in the Pacific is concentrated on Sydney, and important connections are being developed with every country facing that ocean. One of the largest and most massive single-span bridges in the world crosses the harbour to connect the city

with the north shore. To the south, the *Port Kembla* region is rapidly developing as a centre for certain classes of heavy industry utilizing the excellent local coal. Further south again, *Goulburn*, an important railway town on the plateau, and such small coastal towns as *Bega* and *Eden* are the chief centres of settlement until we cross into Victoria. Here *Sale* and *Bairnsdale* are the two rivals of central and east Gippsland, lying in rich agricultural districts. Most of Gippsland is a recently raised portion of the sea-bed comprising a belt about 40 miles wide over which alluvial silt has been spread by the coastal rivers. The present coast is a line of sand-

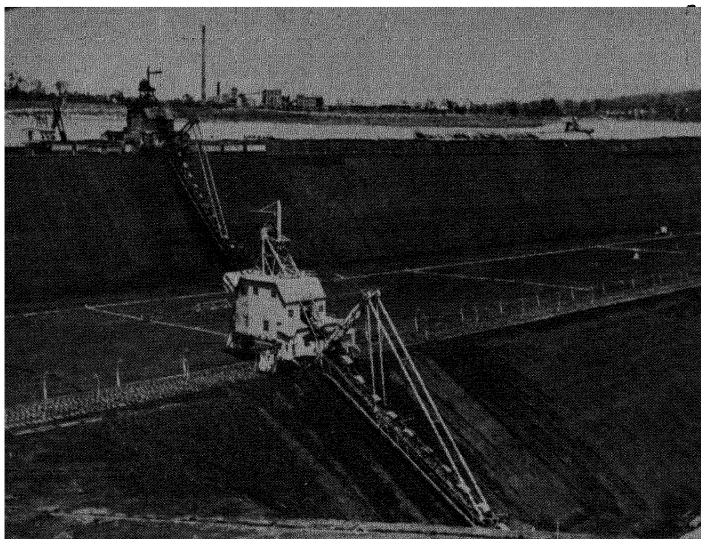


FIG. 71. VICTORIA'S MAIN POWER RESOURCE

Mechanical mining of brown coal in the open cut at Yallourn, Victoria. This deposit is used to generate electrical current which is transmitted for domestic and industrial light and power throughout the State. Note also the briquetting plant in the background. The estimated reserves of brown coal in these deposits are 37 thousand million tons, and a trebled output is planned.

dunes behind which the old estuaries have been enclosed as a series of lakes or lagoons which are being slowly filled with silt brought down by the rivers. In contrast to the recently submerged coast of New South Wales to the north of the Cape Howe corner, the Gippsland coast is deficient in harbours. The lakes have become the seat of a fishing industry partially supplying the Melbourne market.

An industry of great importance to the State of Victoria has developed at *Yallourn*. The most extensive lignite beds known to exist occur here, and the brown coal is used for the generation of electricity which is transmitted all over the State. Apart from its interest as a Government enterprise, with its own complete town, it is remarkable as an attempt to supply power and light to a whole State from a central generating station. In addition, plant has been erected to produce briquettes for both industrial and domestic consumers.

Port Phillip is a drowned portion of the lower valley and flood plain of the Yarra, and is notable as a sheltered seaway into the very heart of the great valley as far as the present Yarra estuary. At its head stands *Melbourne*, the State metropolis, commanding in a remarkable manner the converging routes east-west along the valley, north-south through the Kilmore Gap, and south-west to the Western District. It has thus by a natural development become the central port to the trade of the valley and of the fertile Murray basin across the highlands. It has become also a great industrial centre containing over a million people.

West of Port Phillip lies the remainder of the great valley, immense areas of which have been flooded by basalt in the past. Many extinct volcanoes rise from the surface of this plain, while the blocking of valleys and depressions by the lava sheet has resulted in the formation of many lakes.

In parts of the area, e.g. *Warrnambool* and *Mt. Gambier*, the decomposed basalt and volcanic ash have formed soils of wonderful fertility, while in others the erupted rock has resulted in barren areas suitable only for grazing. *Geelong*

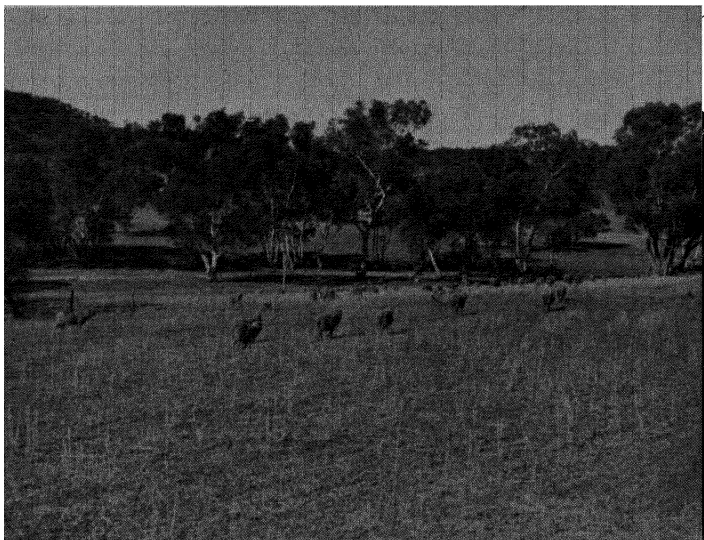


FIG. 72. TYPICAL SHEEP PASTURES, VICTORIA,
SOUTH-EASTERN AUSTRALIA

This is 25-30 inch rainfall country where mixed farming for wool, meat (fat lambs) and wheat is possible.

on a western arm of Port Phillip and Warrnambool in the south-west are the trading centres for this very productive area, known locally as the Western District. Geelong is, in addition, a rapidly developing centre for the manufacture of textiles and motor vehicles. *Hamilton* is the chief inland town of the region. The Otway Ranges are rugged, well-watered areas fronting the Southern Ocean and presenting great possibilities for afforestation.

The plateau region to the north of this valley became after

1850 the scene of great gold-mining activity, and important mining centres such as *Ballarat*, *Bendigo* and *Castlemaine* developed. With the decline of gold production these towns have had to turn to other industries connected with the agricultural and pastoral resources of the area.

2. *Tasmania*

The 'Island State' of the Commonwealth is really a southern extension of the Eastern Highlands cut off by the sunkland of Bass Strait. The consequent isolation, like that of Australia, has had the effect of preserving types of animal and plant life that represent even earlier forms than those



FIG. 73. A CORNER OF INDUSTRIAL MELBOURNE

Yarraville is one of Victoria's greatest industrial concentrations. The Yarra, a short waterway, is navigable for ocean steamers and provides industrial waterfronts for about five miles between Melbourne and Hobson's Bay. The largest steamers berth at Port Melbourne, on the Bay, others at Victoria Docks, off the Yarra.

of the mainland. The most interesting of these were the aborigines who form a most important link in the story of man's development. They failed to survive the contact with the white man, and the last of them died in 1877, unfortunately before adequate study had been made of their habits and customs.

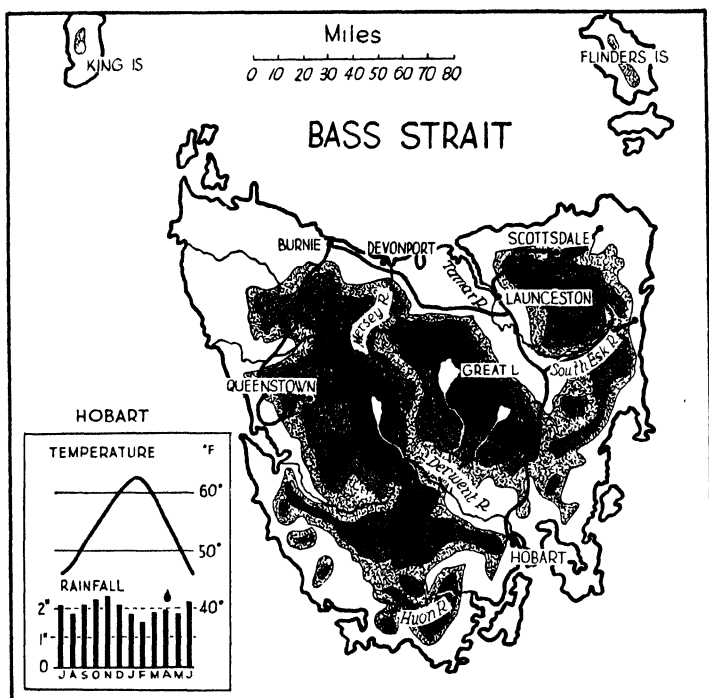


FIG. 74. TASMANIA

The chief features of the island's structure are: (i) the heavily forested *peneplain* area of the west and south-west dissected by the deep gorges of the rivers; (ii) the *Central*

Plateau of about 2,000 feet average elevation consisting of old sedimentary rock capped by a great lava flow, and studded with comparatively shallow lakes lying in depressions in the lava sheet; (iii) the smaller, similar, and higher *North-eastern Plateau* rising to the 5,000 feet summit of Ben Lomond; (iv) the *East Coast Highlands*. Lying between these massive blocks are the South Esk, Macquarie, Derwent and Huon River valleys, which form the main drainage systems. The lowering of the whole area, at the time when Bass Strait was formed, led to the drowning of the estuaries and the formation of the inlets, properly called *rias*, such as the Tamar estuary, Macquarie Harbour, the Derwent and Huon estuaries, and D'Entrecasteaux Channel, which mark the whole coast-line.

Climatically Tasmania forms a distinct region, lying, as it does, so far to the south that it comes under the influence of the Westerlies for the greater part of the year. Generally speaking, the climate is cooler but more uniform than that of south-east Australia, to which it bears a close resemblance in many ways. The westerly direction of the prevailing winds results in the characteristic 'wet and dry side' effect: the west coast receives upwards of 100 inches of rain a year, while some areas in the lee of the central plateau and on the east coast receive an average of only 10 inches. One notable result is the very definite control of forest growth exercised by the rainfall. A feature of the vegetation of the island is the contrast between the dense beech and eucalypt forests of the areas within the 60-inch rainfall line, and the more open country of the east and centre.

Along the north side of the island extensive basalt flows have occurred, and the decomposition of these has resulted in the rich 'chocolate' soils of the north-west and north-east

which form the basis of the island's agriculture. Dairy-farming and potato-growing are the main industries in these areas, contrasting with the sheep-raising of the drier 'mid-lands' and eastern districts. The Derwent, Huon, Tamar and Mersey Valleys are closely settled, with fruit-growing as

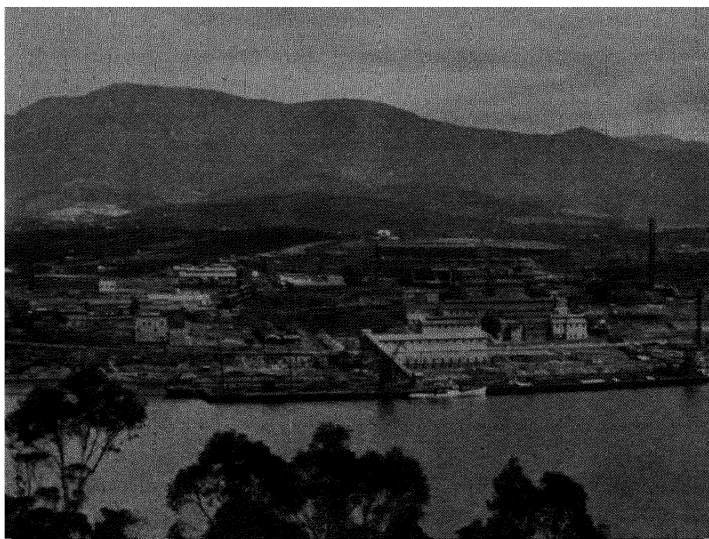


FIG. 75. ELECTROLYTIC ZINC WORKS, HOBART,
TASMANIA

These works depend upon hydro-electric power generated at Waddamana, from Great Lake on the Central Plateau, 70 miles distant. The roasted zinc oxides are brought by steamer from Port Pirie in South Australia, which treats the ores won at Broken Hill, New South Wales. This plant will produce 100,000 tons a year of zinc 99·97 per cent pure.

the main industry. The climate and soil conditions are most suitable for the cultivation of apples, pears, and apricots. Export of fruit to Great Britain and the mainland is important in normal times. The Derwent Valley is notable for the production of hops.

The extensive forests have long been the seat of important saw-milling industries, particularly in the Huon Valley, where one of the finest eucalypt forests in the Commonwealth formerly existed. This industry has expanded in response to the growing need for forest products. The manufacture of writing and kraft papers has been established at Burnie, and of newsprint at Boyer on the upper Derwent.

The ancient rocks of the island are extremely rich in minerals. Almost every known mineral occurs somewhere on the west side, but the silver-lead-zinc of the Mount Read-Rosebery district and the copper ores of Mount Lyell are the most important. The tin deposits of Mount Bischoff are now almost exhausted, but mining for this metal is carried on in the granite country of the north-east. Coal is found in many places in the island, but generally the seams are thin or the coal of poor quality.

The comparative poverty of the coal areas, however, has not proved a great deterrent to the island's industry because of the natural advantages it possesses for the generation of hydro-electricity. The lakes of the Central Plateau, the drainage from which falls from 1,800 feet to sea-level within 50 miles of the plateau, provide ideal conditions for power plants. The waters of the Great Lake are led by canal and pipe lines to *Waddamana* in the Ouse Valley, and the energy there developed is transmitted to Hobart, 60 miles away, where the power is used in several important industries of which the electrolytic zinc works at *Risdon* are the most notable. Another scheme at Tarraleah now utilizes the water of Lake St. Clair, and a large dam at *Butler's Gorge* is now completed. Metal refining, manufacturing industries in various parts of the State, and the metallurgical industries at *Queenstown* on the west coast receive their power from these plants.

Hobart on the Derwent estuary commands a number of excellent water routes to the timber and fruit districts of the

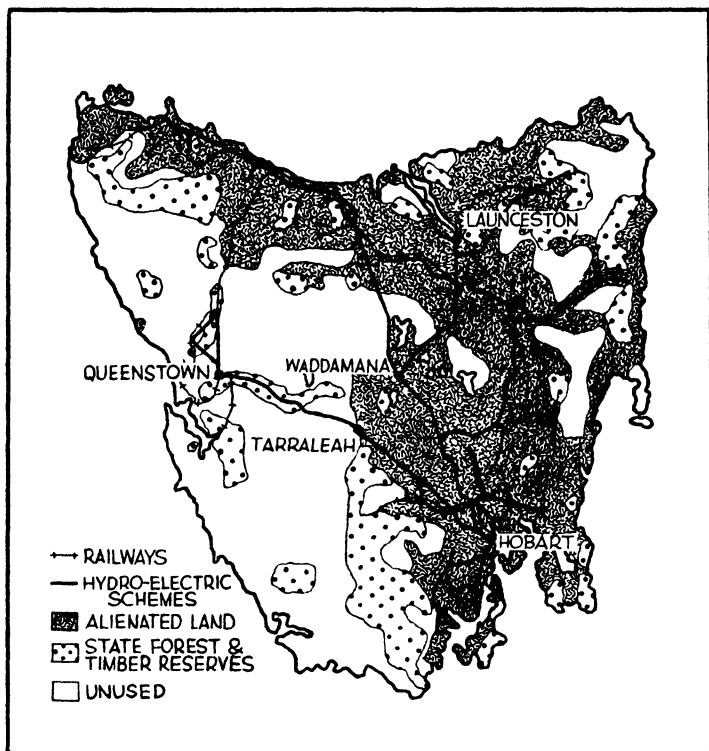


FIG. 76. Tasmania, showing the concentration of settlement in the central valleys and along the north coast, and the hydro-electric and railway networks.

south-east and has become the chief overseas port for the State. Industries such as electrolytic zinc refining, chocolate and newsprint manufacture, all relying on hydro-electric power, have been established in recent years. The east and

Modern methods of dry-farming and the use of fertilizers have considerably enhanced the value of the Mallee areas, which until quite recent times were regarded as almost worth-



FIG. 78. WOOL FROM THE WESTERN PLAINS

Motor transport now carries the wool in bales of about 300 lbs. each to the nearest auction sales in a fraction of the time formerly taken by the horse or ox-drawn waggon; but the State-owned railways suffer serious loss of revenue.

less. However, some of the land taken up for wheat cultivation was distinctly 'marginal,' and soil erosion has set in. Some areas occupied in the first burst of optimism have been converted to sheep pasture, but they still remain a problem. An extensive scheme of open channels by which water for stock is brought from Lake Lonsdale for a distance of 250 miles, has been responsible for a considerable increase of sheep on the wheat farms in the area where they are pastured

on the fallows. (ii) The drier *grazing area* which occupies the remainder of the basin, or about half the area of New South Wales. Considerable overlapping of the sheep and wheat belts occurs towards the Eastern Highlands, but nearly half of Australia's 120 millions of sheep are pastured in the basin, which constitutes the world's most important area of fine wool production. The highly fertile Riverina district lying between the Murray and Murrumbidgee calls for particular mention in connection with both wool and wheat production. The chief centres for this area are

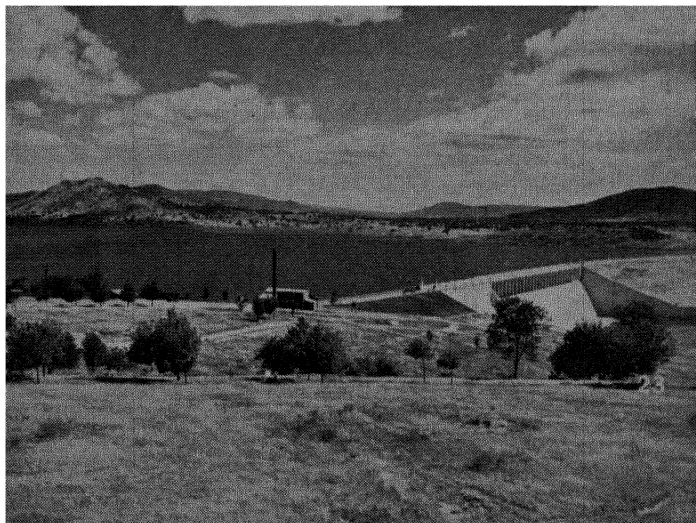


FIG. 79. AUSTRALIA'S LARGEST DAM

The Hume Reservoir near Albury.

Wagga Wagga and *Hay*. (iii) The *irrigation areas* which have been developed in the basin, especially along the lower Murray and the tributary streams of the Murrumbidgee and

the Goulburn. The main difficulty of irrigating the valley arises from the fluctuations in the volume of the water carried down by the rivers of the system. A commission representing the governments of the three States concerned and the Commonwealth has been formed to co-ordinate the development of the Murray Valley. The first problem was that of storing the waters to provide an adequate flow for both irrigation and navigation during the dry summer. The greatest project is the Hume Reservoir, which controls the waters of the upper Murray by means of an immense storage basin with a capacity of 1,250,000 ac. ft. Another scheme has provided fourteen locks and weirs at regular intervals along the stream to regulate the flow to the lower Murray, and to permit navigation.

Apart from these major schemes under the control of the River Murray Commission, each of the three states has completed important irrigation works. The Murrumbidgee Irrigation Area is supplied from the Burrinjuck Dam 200 miles farther upstream, and has become one of the most important fruit-growing and dairy-farming districts in New South Wales, in addition to growing sufficient rice to meet the needs of the Commonwealth. There are several irrigation schemes on the Victorian side, the most important of which, apart from those on the Murray, is that of the Goulburn Valley which has increased the productivity of the region enormously. The waters of the Loddon are used in a similar way, but the scheme is not nearly so extensive. At *Mildura* in Victoria smaller areas are irrigated on a more concentrated plan for the production of citrus and vine fruits, the basis of the dried fruit industry.

The South Australian portion of the Murray is a fine waterway for over 300 miles, and great use of the river is made for irrigation purposes. Large pumping plants have

been installed, and between Morgan and the Victorian border a number of important fruit-growing areas have been established, of which the most outstanding are *Renmark*, *Berri* and *Barmera*. The extension of fruit-growing in these districts now depends not upon water supply but upon the securing of adequate markets for the increasing output. Still farther down the river the swampy flood plain has been drained, and dairy farming has become an established industry. A double pipe-line now supplies water to Whyalla, on Spencer Gulf, from Morgan, 300 miles away on the Murray.

An unsatisfactory feature of the region is the character of the mouth of the Murray. The river discharges into the Lake Alexandrina, a great lagoon; and the waters reach the ocean through a break in the dune coast-line. For navigation purposes the entrance is useless, and this is a serious handicap to the economic development of the lower Murray Valley. A series of barrages or dams keeps the waters of the estuary fresh.

4. *The South Australian Highlands and Sunkland*

The highland system which causes the Murray to make an abrupt bend to the southward after crossing the South Australian border extends away to the north for 300 miles as the Mount Lofty and Flinders Ranges. These highlands rise towards the north, where peaks of over 3,000 feet are situated, but in general the ranges rarely rise to 2,000 feet. This is sufficient, however, to give the hills a higher rainfall than the adjacent plains. The hill slopes are consequently areas of cultivation, and fruit-growing (grapes, apples, almonds, olives) is a staple industry. An important subsidiary industry is wine-making, and the greater part of the Australian vintage comes from this region.

In the early days this area was noted for its copper production, and famous mines existed at *Burra*, *Kapunda*, and *Moonta*. The industry has declined of late years, and the mines are mostly idle.

Between the South Australian highlands on the east and the south-western corner of the Great Western Plateau lies a great north-south depression now generally known as the Spencer Gulf-Lake Torrens Sunkland. The plains east of the Sunkland are the most productive part of the State. In the south, where the rainfall is above 10 inches, the plains form part of the wheat belt, which merges to the north into the pastoral belt. *Adelaide*, a city of 330,000 people, stands on this plain at the foot of the Mount Lofty Ranges and at a distance of about six miles from the Gulf of St. Vincent. It is favourably situated as a centre for collecting the products of both the valley and the highlands. The disadvantages of the long and extensive haul over the Lofty Ranges and the dearth of a good harbour have been successfully overcome; and many important manufactures have developed, chiefly at *Port Adelaide* on a navigable arm of the Gulf and at *Salisbury*. *Walleroo* occupies a somewhat similar position on Spencer Gulf. Once associated with the copper industry, it has now become a wheat port. *Port Pirie*, farther to the north, is a busy industrial centre dependent upon the mines of Broken Hill. The products of the silver-lead-zinc smelting and the wheat and wool from the northern plains are the chief export commodities. At Whyalla the iron-ores from the Saddleback Ranges are shipped to the steel-works at Newcastle. In 1938, blast furnaces were established, using the coal sent from Newcastle as backloading, and this town is now rapidly developing as a centre of the steel and shipbuilding industries. Brown coal is mined at *Leigh Creek* in the interior. *Port Augusta* has an important situation at

the head of Spencer Gulf, where the Transcontinental railway rounds the inlet. The building of this line enhanced its importance as an outlet for the northern end of the bay.

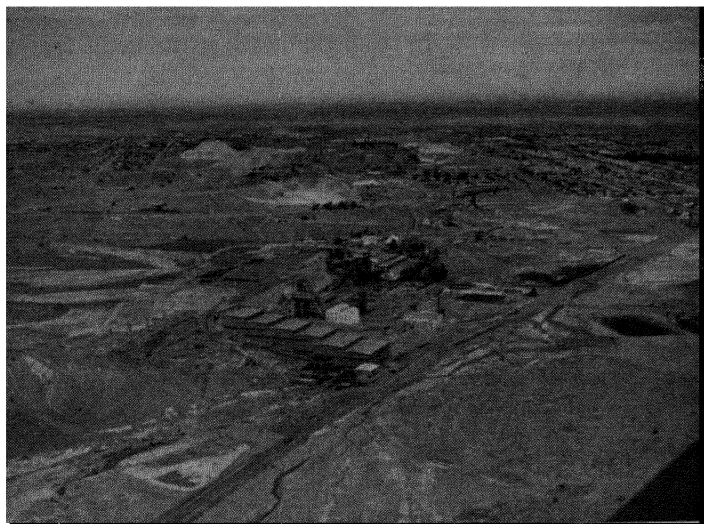


FIG. 80. MINING IN THE ARID CENTRE

Broken Hill, one of the world's mineral wonders. The vast silver-lead-zinc deposits have yielded metal to the value of £200,000,000 since 1883. In the near future the community will be supplied with water by pipe-line from the Darling River, 300 miles distant.

The ores are sent to Port Pirie, S.A., for treatment.

An industry of some importance is the recovery of salt from the shallow salt-pans of the area.

5. *Western Australia*

The settled portion of the great western State consists merely of the south-western corner of the Great Plateau, a fertile region that enjoys very reliable rainfall. The greater

portion of the State, approximately one-third of the area of Australia, is thus comparatively uninhabited. The tropical north of the State has already been discussed under the section on North Australia.

A gradual thinning out of the vegetation owing to diminishing rainfall away from the coast is the main feature of the area. Thus in passing from the south-west corner towards the centre of the plateau, the zones of vegetation are as follows: (i) the wettest south-west corner with splendid karri forests; (ii) the jarrah forests shading off into (iii) the drought-resisting eucalypts of the mallee type; (iv) the still drier region characterized by mulga scrub—a species of acacia; (v) the salt-bush of the semi-desert; and finally (vi) the desert proper.

The economic development of the region consequently falls into zones that are quite as definite as the vegetation belts, with which indeed they largely correspond. In the true Mediterranean region of the south-west, fruit-growing, dairy-farming, and timber-cutting are the main industries. The timbers from this area, karri and jarrah, are of the greatest value on account of their durability and mahogany-like colour. Behind this area lies a belt where wheat-growing has been greatly developed in recent years. The industry has been handicapped by the great variability of the soils. Satisfactory farming techniques have been evolved and better varieties of wheat produced so that greater stability in the industry can be expected. Large areas are now being 'reconstructed' as pasture. Between the wheat belt and the desert proper lies an extensive pastoral area under sheep. Here the chief difficulties are the lack of domestic water and of fodder during drought seasons.

The forests of the State are splendidly managed. Industries dependent upon the forests are found throughout the

karri belt. Saw-milling on an extensive scale is carried on; a tanning extract is obtained from one of the eucalypt species; and extensive planting of soft-woods is being carried out. *Manjimup* is the chief centre, while *Wagin*, *Katanning* and *Narrogin* are the chief towns of the Great Southern. Further

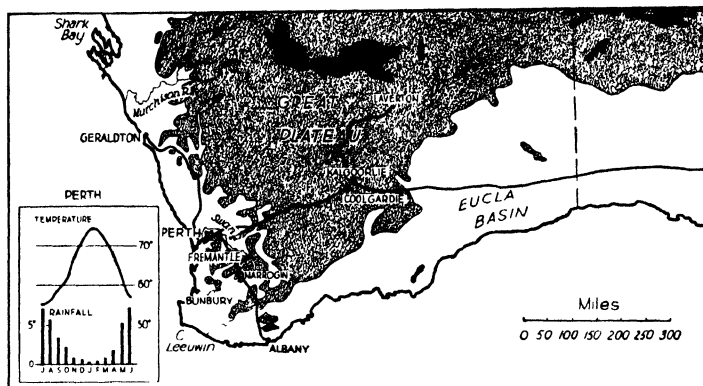


FIG. 81. South-western Australia.

north *Northam* and *York* are agricultural and pastoral centres. *Geraldton* is the chief port of the area lying north of Perth. *Bunbury* is an early settlement which has become a secondary port to Fremantle for the south-west.

Perth on the Swan River (210,000 people) is the capital and largest town of Western Australia and nearly all the factories of the State are here or at *Fremantle*, the port 12 miles away on the coast. Fremantle has become an important naval base; and it is the first Australian port of call for east-bound steamers. In the south *Albany*, on King George's Sound, stands on a splendid harbour. Lying between Perth and Albany behind the coastal scarp is the wheat and sheep belt threaded by the 'Great Southern' railway. This is the most productive area of the State. Between

the coast ranges and the sea is a fertile strip of irrigated country where dairying has been developed. Vines, citrus fruits, apples, tobacco, and other crops are grown in the reliable rainfall areas of the south-west.

The southern edge of the plateau is remarkable for other reasons than that of agricultural or pastoral development. Here the rainfall is scanty and unreliable, but the presence of gold-bearing reefs led, after 1890, to a 'gold rush' that resulted in the establishment of big mining centres such as *Coolgardie*, *Southern Cross* and *Kalgoorlie*. But the 'Golden Mile' and similar areas are now almost deserted. Kalgoorlie, the last of the giants which still precariously maintains the industry, has two features worthy of notice, viz., the great pipe line, 325 miles in length, which brings the water supply from the coastal belt, and the change-over or 'break of gauge' between the Western Australian and Trans-continental railway systems. The great desolate area of the Nullarbor Plain with its characteristic salt-bush vegetation lies to the east. To the north-west is a great area where cattle raising, especially in the Kimberley district, is the main occupation. Between *Wyndham* and *Geraldton* and back from the coast is a region of sheep country—always difficult and often almost waterless.

Australia has only two known deposits of iron ore of sufficient extent and quality to sustain a large-scale iron and steel industry. The first is near Whyalla in South Australia, and it is the basis of the B.H.P. mills at Newcastle (N.S.W.). The second is at Yampi Sound in the north-west of Australia, about 200 miles north-east of Broome. Extremely rich deposits exist on three islands in the Sound; but there is no coking coal on this side of the continent. Despite this shortcoming the State Government plans to set up a steel industry.

Western Australia, like South Australia, lacks high-grade fuel as a source of industrial power. The best available fuel is the sub-bituminous coal of *Collie* which is to become the State's main centre for the generation and distribution of electric power, chiefly to the secondary industries of Fremantle and Perth. At *Wundowie*, about a hundred miles north-east of Perth, the government has established a charcoal-iron industry based on wood supplies from the adjacent forest.

The alkaline deposits of the salt lakes are now engaging the attention of scientists. Alumina is being recovered from Lake Campion, and the large-scale extraction of other chemicals is being commenced.

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PART IV

NEW ZEALAND

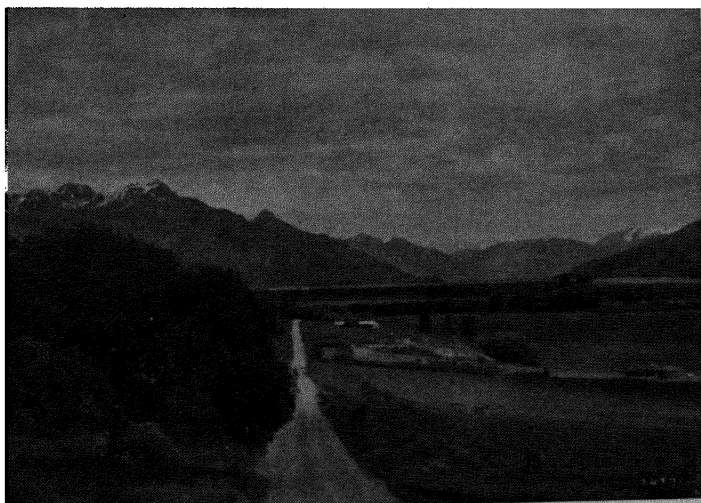
CHAPTER XVIII

PHYSICAL AND CLIMATIC

1. *A Brief Historical Survey*

MUCH of what was said about Australia's position in the Pacific applies also to New Zealand. If Australia is isolated, New Zealand is more so. Australia faces both the Indian and Pacific Oceans; New Zealand is thrust far out into the Pacific, and to a far greater extent maritime conditions control her outlook and development. Her native people—the Maoris—are an offshoot of the Polynesian race and came from their distant homeland in the very heart of the Pacific. Her white-race inhabitants are sprung from another island people in remote Britain. In a very direct way the adventurous navigator strain of the Polynesian mingles with the explorer-pioneer strain of the British stock. The salt water is in the blood of both.

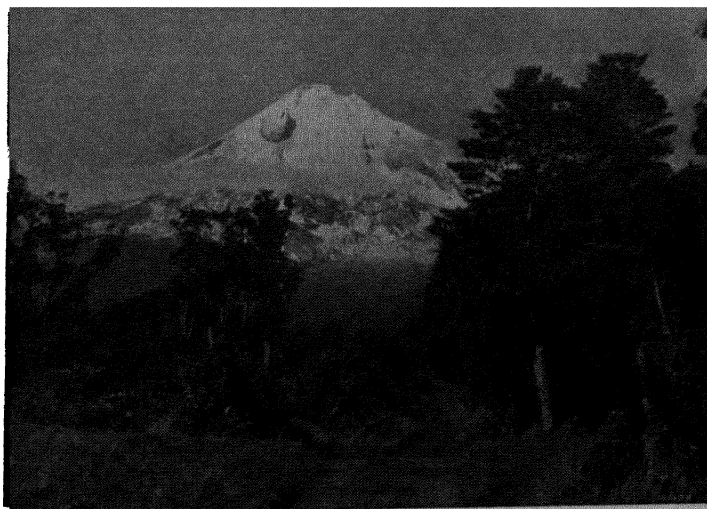
It would be surprising if the mingling of Polynesians who came half-way across the Pacific with Europeans who came half-way across the world to occupy this last considerable land projection into the greatest of the oceans did not produce a people who were enterprising and self-reliant. And what a rich and attractive land is that to which they came! From volcanic cones and geysers of the North Island with its euphony of Maori place names—Waimangu, Wanganui, Tongariro, Maunganui—to the alpine South Island, where the ring of the names seems to change with the character of the land itself—Wakatipu, Moana, Te Anau, Oamaru—is



FIGS. 82 and 83. MOUNTAIN CONTRASTS

These two views indicate the magnificence of New Zealand's scenery. *Upper*—Lake Hayes near Wakatipu, South Island.

Lower—Mt. Egmont, North Island, an extinct volcano.



variety unexcelled. The British settlers have largely preserved native names with appreciation and pride, for they reflect the unusual beauty and dignity of the land itself.

This was the land that Abel Tasman discovered in 1642. Thus early, the frontiers of European imperialism were stretching out into the East Indies and beyond into the South Seas. The restless search for treasure islands and new territories could not be halted. But it was not till Captain James Cook re-discovered and explored the coasts in 1769 that the policies of far-away Europe really touched this remote Polynesian colony. In later years the wave of European migration broke over and almost submerged the most developed Stone Age civilization the world had seen.

The land was a fitting stage for one of the great dramas of the Pacific Ocean. The invasion of the European and the occupation of the country began the troubled history of the nineteenth century. After a gallant struggle for homeland and independence against the intruders, and a clash that was really not a war between different races so much as a war between different civilizations, agreement was reached and Maori rights in the land recognized by the Treaty of Waitangi (1840). Although hostilities persisted for another 40 years, Maori and Briton finally settled down to a system of co-operation based on a recognition of native rights, and of the Maoris as British subjects.

The later history of New Zealand is full of interest, and deserves to be better known. The development of the country made great strides marked by 'ups and downs' of most colonies dependent upon primary industries. In 1907 New Zealand gained the status of a Dominion, and later played a full and distinguished part in the development and defence of the Empire. The difficult depression years after

1930 were largely responsible for much social legislation that has placed the Dominion high among the advanced countries of the world.

2. *Structure and Surface*

Whether we regard it from the aspects of structure, position, plant and animal life, or human types, the Pacific Basin contains no more interesting group than the islands comprising the Dominion of New Zealand. Its isolation to the south of the great ocean appears to be complete, and even an examination of the ocean floor reveals no very intimate connection with any of the continental land-masses. To the west a vast basin—the Thompson Trough, 700 miles wide and 15,000 feet deep—separates the group from Australia; while on the east the land drops steeply to another deep depression. Ocean soundings have, however, revealed the presence of two long submarine ridges stretching out like the prongs of a fork, and continuing the main lines of the surface features far to the north. One of these runs clear from the mountain chain of the South Island, through the ranges to the east of the North Island and away under the sea to reappear in the peaks of Kermadec, Tonga, Fiji, and Samoa. For the greater part of its length this ridge is less than 5,000 feet below the surface; and, on its east side, it falls sheer into the immense abyss of the Aldrich Deep, where the soundings of 30,000 feet have only been exceeded in the famous Tuscarora Deep to the east of Japan and in the Philippine Trench. The second ridge maintains roughly the direction of the Auckland Peninsula, and runs in parallel lines as far to the north as New Caledonia. The three main islands are thus merely an unsubmerged fragment of a great system of folds that rises steeply from the ocean floor, and is broken by Cook and Foveaux Straits. Total area is 103,000 sq. miles.

The length of the New Zealand group, in all about 1,200 miles, as compared with the average breadth of about 120

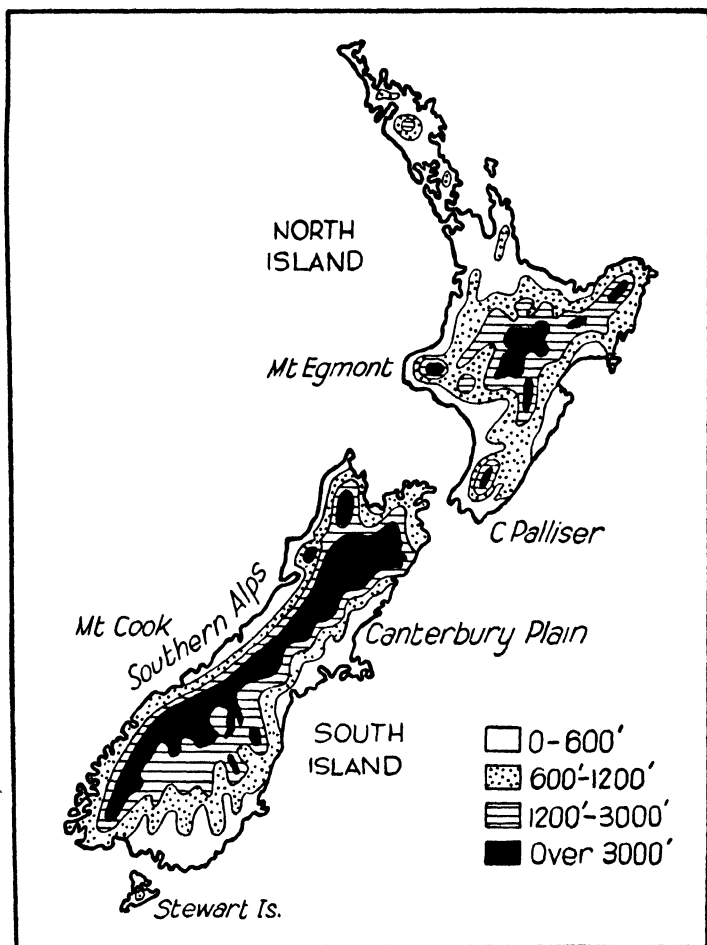


FIG. 84. New Zealand—Topography.

miles, is thus accounted for. Also, since the main direction is north-east and south-west between the parallels of 35° and 48° south latitude, the shape and position of the islands is the controlling factor in determining the variations of climate, the types of native and introduced vegetation that flourish, the consequent animal life of the region, and the nature of the communications. It is not too much to say that no better example of the effect of climate on human development is to be found anywhere in the world; and, as we shall see, the features that have just been sketched are everywhere the dominating influence over life in the Dominion.

The second strong influence is the character of the surface throughout the islands. Extending throughout the whole length of the South Island but, in general, much closer to the west coast than to the east, runs the great system of parallel folds known as the Southern Alps. Fronting the Southern Ocean as a high rampart dipping steeply to the sea on the west side, the system is drawn out on the eastern side into many side-spurs and ranges that gradually flatten out towards the extensive plains of Otago and Canterbury. The great glaciers form the chief geographical feature of this true alpine region. Owing to the heavy precipitation and the steep slopes these glaciers assume majestic proportions in the neighbourhood of Mount Cook, the fine peak rising to over 12,000 feet, which was known to the Maoris as Aorangi or Cloud Piercer. Of the glaciers the Tasman is the most notable, being nearly 20 miles long and about $1\frac{1}{2}$ miles wide; but others such as the Hooker, Mueller, Fox, and Franz Josef are all over 8 miles in length. As a result of heavy glaciation in past ages which left great moraines piled up across the lower ends of many of the deep valleys, many large and extremely beautiful lakes occur in the southern area. Long, narrow, and enclosed by sheer walls of rock, they lie in the very heart of the alpine ranges. The chief

examples of these glacial lakes are Te Anau, Wakatipu, and Manapouri. The Kaikouras in the north-east and the Otago

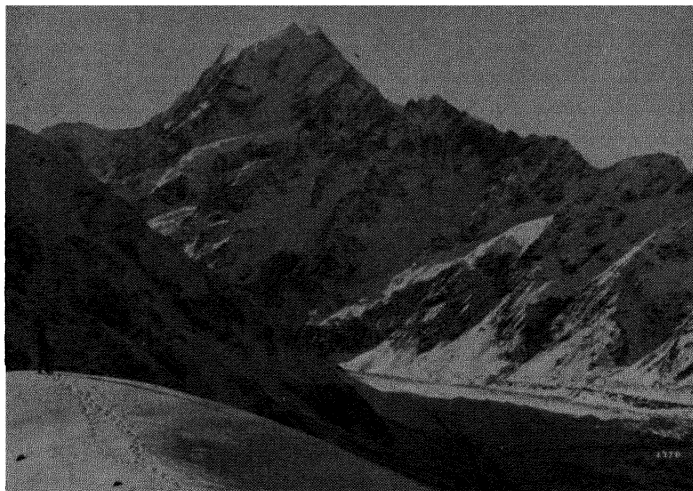


FIG 85. "AORANGI" OR "CLOUD PIERCER"

Mt. Cook dominates the cold majesty of the Southern Alps.

Mountains in the south are detached systems, in general lower than the main range and seldom reaching more than 6,000 feet in elevation. The extreme south of the South Island and Stewart Island are a knotted area whose highest point, Tutoko, rises to 9,000 feet. Of this region Professor Marshall has finely written :

'Sublime in their stark and stalwart forms, sombre in their vesture of forest, the standing rampart of the land to the wet winds of the west, these forbidding ranges are yet untouched save by the foot of the hardiest explorers. The mighty precipices of these mountains, their leaping waterfalls and embosomed lakes, are doubtless due to glacial erosion . . . Stewart Island is no more than a partly drowned southern extension of this mountain mass.'

There are thus three main types of surface to be met with in the South Island: (i) the true alpine system already described, at the northern and southern ends of which the valleys have been 'drowned' to form the majestic *fiords* to the north of West Cape and the less rugged *sounds* of the coast facing Cook Strait; (ii) the foot-hills or 'Downs' as they are called, a strip of varying width seldom rising more than 2,000 feet and originally covered with dense bush; and (iii) the Plains which are really extensive gravel deposits formed by the action of rivers and glaciers in past ages.

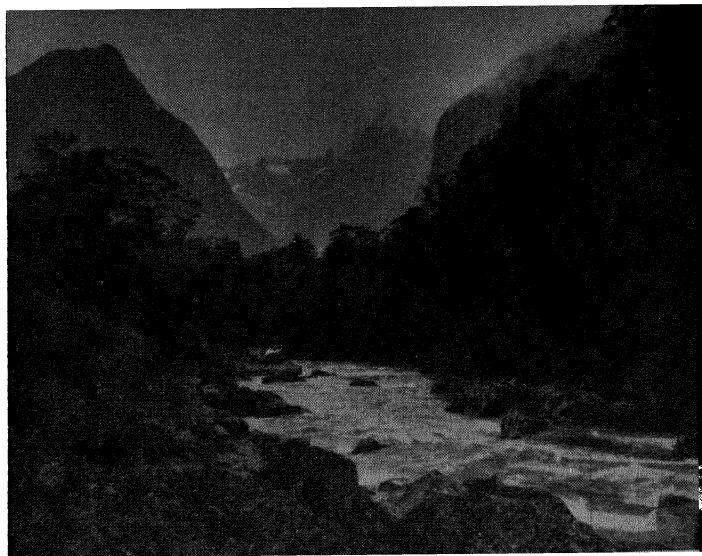


FIG. 86. An unusual view of the famous Milford Sound.
Note the U-shaped valley.

In the North Island the main mountain system lies nearer to the east coast and is more flattened out, as it were, so that

the chief summits scarcely reach 6,000 feet. The area, however has been carved into deep gorges by the Manawatu and other streams, so that it has become a series of rugged blocks, clothed for the greater part with forest. The Tararua, Ruahine, Kaimanawa, and Raukumara Ranges preserve, from Wellington to East Cape, the main direction of the southern system. On the west side of the mountain mass there is a stretch of broken country clear across to the west coast, and a narrow belt of foot-hills is found on the eastern side. The plains of the North Island are relatively small in extent, and are confined to the coastal areas on the east and south. There are downs to the west of the volcanic plateau described below.

Lying to the north-west of the mountain region in the North Island is a remarkable volcanic plateau about 50 miles in width, stretching from Lake Taupo to the Bay of Plenty. This is an area where volcanic activity is still prominent, although it is probably in the declining stage; and, as a consequence, the surface is, in the main, a great barren pumice-covered plain. Rising from this plain are isolated volcanic peaks still more or less active. The highest of these, Ruapehu, rises from the centre of the island to 9,000 feet, while Ngauruhoe and Tongariro surpass 6,000 feet. Tarawera, whose destructive outburst of 1886 is still remembered with dread, and the beautiful lonely peak of Egmont are now apparently extinct.

The Thermal Region, as the northern part of the volcanic area is usually called, exhibits the geysers, hot springs, and other activities which are usually associated with the decline of the eruptive stage. The lakes of the volcanic region, too, offer a strong contrast to those of the South Island. For the most part shallow and circular, they occupy basins in the plateau, although a few have been formed by lava dams

thrown across the valleys in times of extensive eruption. Taupo, Rotomahana, and Rotorua are the largest and best-known of these lakes. The remainder of the island to the north is much lower, and its chief feature is the wide stretches of sand dunes between the higher portions.



FIG. 87. DAIRY FARM, WAIKATO VALLEY

After this general description something more must be said of the steppes and plains since these have such an important influence over man's activities in both islands. The downs of the North Island are really part of an elevated old sea-bed now much eroded and too rugged in general for farming, but forming excellent pastures. The same may be said of the Auckland Peninsula and the foothills of the South Island, which are pastoral and more amenable to cultivation, although they shade off in the south and west to wild districts still comparatively uninhabited. The plains proper, although a

relatively small part of the surface, form the chief farm lands of the Dominion. The most important by far are the fertile Canterbury Plains, an area approximately one hundred miles long by twenty miles wide, forming the agricultural heart of



FIG. 88. HARVESTING WHEAT IN THE CANTERBURY PLAINS

The Canterbury Plains, source of the noted "Canterbury lamb," are amongst the most fertile regions in New Zealand.

New Zealand. An area of increasing importance in the North Island is that of the Waikato Valley, still largely undeveloped but rapidly coming under cultivation. Another notable district, varying in its character and production from the Canterbury Plains, known as the Southland Plains, extends behind Invercargill. Smaller, but still important, plain areas occur near Nelson (Waimea and Motueka), Wellington (Wairarapa), Napier (Heretaunga), and the Bay of Plenty.

As would be expected from the 'lie of the land' the rivers on the west of the South Island and the east of the North Island are short, rapid mountain streams. Only in the plain country have matured river systems been developed; but few of them are of much use for transport on account of their shallow depth, a bad habit of changing their courses, or because of the sand bars that obstruct their mouths. The rugged gorges through which most of them break at some point on their race to the sea are a striking feature of the landscape in both islands.

A word must be said concerning the coast-line, which, while rich in inlets, is deficient in safe harbours at suitable points for shipping. The west coast is exposed to the buffeting of the prevailing westerlies and the great rollers of the Southern Ocean, while the east coast is dominated by the south-west current, which piles banks of sand and shingle across most of the entrances. Many fine harbours exist, however, where the coast-line runs across the grain of the country. The harbours of Auckland and Wellington are deservedly noted among the world's best anchorages.

3. *Climate*

Considerable variation in climate will be expected in a country that extends through 12 degrees of latitude, and in which the grain of the country is, in general, opposed to the direction of the prevailing winds. Actually the two main islands are influenced by such different climatic controls that they must be treated separately. Because of its position in relation to the wind systems of the southern hemisphere the North Island has the closest affinity with the Mediterranean type of climate, while the South Island must be placed in the same climatic group as Tasmania and British Columbia, i.e. the group in about 40° latitude dominated by prevailing

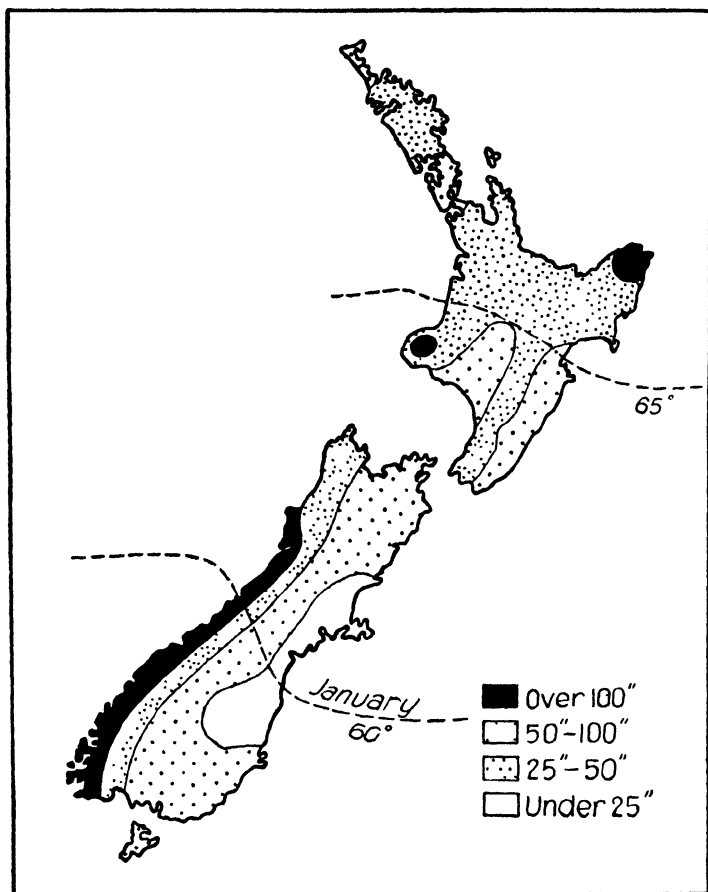


FIG. 89. New Zealand—Rainfall and January isotherms.

westerly winds. It must be borne in mind, however, that New Zealand, by virtue of its insular position, escapes extremes of temperature and that its climate is, in general, of the maritime type.

This is borne out by records which show that the difference between mean summer and mean winter temperature is only about 15° F. for both Auckland and Dunedin, and that the difference between the highest and lowest recorded temperatures for the whole Dominion is less than 50° F. Inland, the annual ranges of climate is greater; and the frequency of frost increases in proportion to the distance from the coast. Despite the equable climate, the difference between the average summer and winter temperatures is marked enough to give that stimulus of changing seasons which is necessary for the white man. The advance made by the Maoris beyond other Polynesian races is ascribed to the influence of a climate that called forth their energy and made them plan for a barren winter season.

The chief climatic distinction between the main islands, or more precisely between those parts of the Dominion lying approximately north and south of a line joining Wanganui and Napier, is due to the different systems which control the atmospheric pressure over these areas. The southern section comes more under the influence of the low pressures connected with the westerly wind belt which also affects Tasmania. The northern area is affected by less frequent depressions generated in the equatorial belt and moving from the north-west. These depressions, as they merge into the stronger eastward drift affecting the southern area, set up violent storms which result in low temperatures and bring much rain to the eastern side of the North Island.

The 'rain-shadow' effect resulting in a pronounced wet and dry side, which has already been noticed in Tasmania, is

repeated in New Zealand; and the west side of the South Island receives rainfall above 100 inches a year, while the east coast receives on the average only 30 to 40 inches. Part of Otago indeed receives only half of even this relatively low rainfall. Although, on the whole, the rainfall is better distributed in the North Island, there are variations from well above 100 inches on Mount Egmont to an average of about 40 inches in parts to the east. As protracted droughts are comparatively rare, however, this rainfall is everywhere sufficient for agriculture, and in most parts is ample for forests.

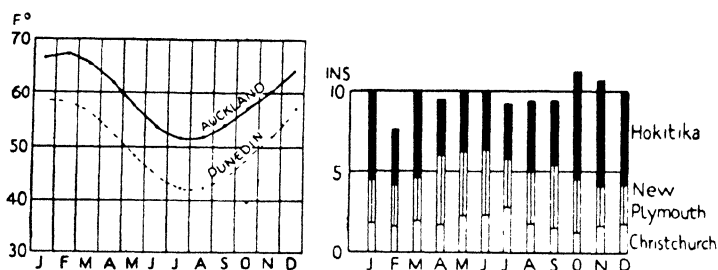


FIG. 90. TEMPERATURE AND RAINFALL FOR SELECTED LOCALITIES, N.Z.

Note the heavy rainfall of Hokitika on the windward side of the Southern Alps and the lighter rainfall of Christchurch on the leeward side.

CHAPTER XIX

ECONOMIC SURVEY

1. *Vegetation*

AS would be expected, there is a very close relation between rainfall and vegetation which results in a remarkable variety of plant types. From the dense evergreen forests of the wetter valleys and lower mountain slopes to the grass plains of the uplands, and from the sub-tropical forms of the north to the sub-arctic types of the southern highlands, almost every type of plant life is represented. New Zealand is particularly well endowed with hardwoods and softwoods; but the forests are rapidly receding before settlements, and already some of the indigenous trees are becoming exhausted. The most valuable of these is the kauri, a magnificent softwood attaining great dimensions, very slow in growth, and limited to the northern peninsula. The chief timber now obtained from the forests is the rimu, another softwood, which is largely exported to Australia. In the south various species of beech are the predominant types. Apart from the timber of the temperate forests the chief native plant of economic value is the New Zealand 'flax' (*Phormium tenax*), from the long blade-like leaves of which a strong fibre is obtained.

Probably one-third of the whole surface of the islands is covered with bush of some sort, but the stands of good timber trees do not exceed five million acres. Realizing the very grave dangers of deforestation, the government has now taken control of forest lands; and, in addition, much planting of European pines has been undertaken by private enterprise

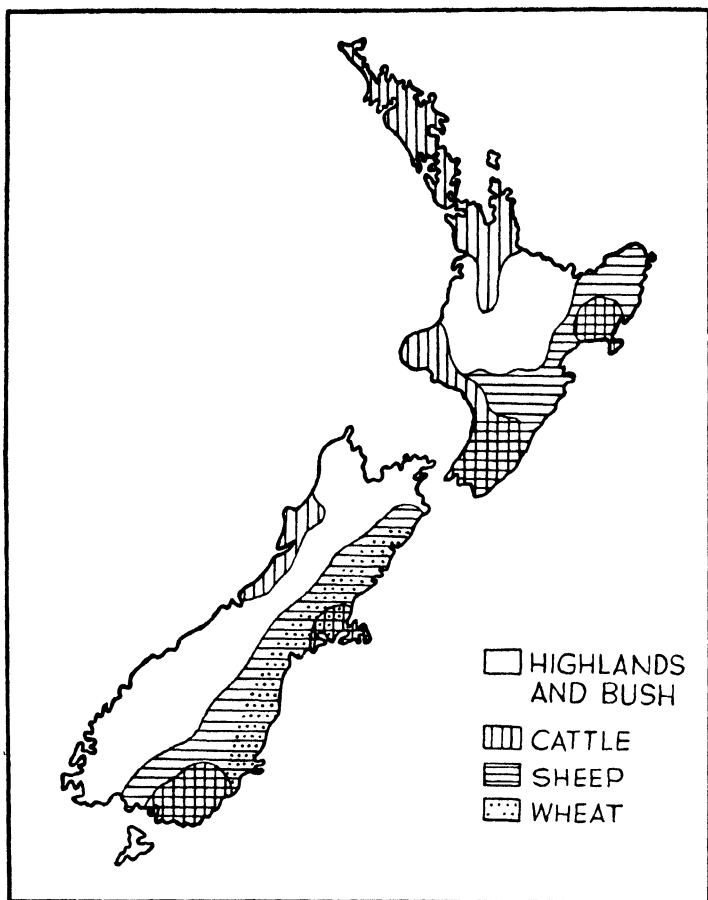


FIG. 91. New Zealand—Major Land Use Regions.

on the pumice lands of the North Island. The chief feature of settlement in the Dominion has been the replacement of forest by grasslands. Both soil and climate favour the production of grass, which, in fact, constitutes the chief crop in New Zealand.

The proportions of the Dominion that are devoted at present to forest, pasture, and farm are rather difficult to estimate, but probably 60 per cent. of the whole surface is capable of some use either as grassland or farm. But only about two million acres are cultivated for crops, of which wheat, oats, and turnips are by far the most important. The Canterbury Plains form the granary which produces four-fifths of the wheat crop of the Dominion. The remainder comes mainly from the Southland Plains, where an adjustment, determined mainly by climate and soil, has led the farmers to specialize more in the production of oats, turnips, and potatoes. Oats, however, are also grown on the Canterbury Plains and to some extent in the North Island. The average yield per acre for five seasons was 34 bushels for wheat and 50 bushels for oats, both very high yields compared with 12 bushels for both wheat and oats in Australia. The better rainfall, more fertile soils, and more intensive methods of the New Zealand farmer account for this result. The total crop of wheat, averaging about 7.5 million bushels, is not always sufficient to supply the Dominion's needs and in late years considerable amounts have been imported.

One industry which is playing a large part in the export trade is the production of fruit, particularly apples, which are well suited by the climatic conditions around Cook Strait. They find their ideal environment in the valleys of the Nelson Province, where hops are also grown. In 1946 about 18,000 acres were in bearing in both islands.

2. *Animal Life*

New Zealand was originally very poor in native animal life—the only mammals represented were a dog, a rat, and two bats. The dog, or rather his ancestors, probably came with the Maoris in the same manner as the dingo is supposed to have reached Australia. A peculiar distinction in the fauna was the number of flightless, or nearly flightless, birds ranging from the great moa, now extinct, to the kiwi, and including also forms of the parrot and the duck. These native types are dying out before the advance of the white man and the birds and animals introduced by him. The sparrow, starling, and rabbit, to mention only a few, are examples of introduced types that are proving serious pests. More useful and attractive immigrants are the deer, now numerous throughout the Dominion, and the trout which are now thoroughly acclimatized in all streams. Anglers find good sport both in these streams and among the islands off the coast. Fish are abundant everywhere, and the introduction of the Alaskan salmon to the glacial streams of the south-west is an interesting experiment that promises to be successful. Seals abound on parts of the coast, and whales have been the basis of an industry for many years in Antarctic waters. The revival in whaling which has recently taken place is due to a change in method whereby a large mother ship takes the place of a shore-station. Control is almost entirely in the hands of Scandinavians; but in recent years Japanese and Australian interests have been strongly represented. Oyster-beds, especially around Stewart Island, supply another important item of production.

Since the area under crops in the Dominion is merely two million acres, while the area sown with grass—apart from the rougher uplands that are natural pastures—amounts to

seventeen million acres, it is easily realized that the grasslands of New Zealand form its greatest economic asset. An interesting specialization has taken place in the pastoral industry as a result of which the North Island has developed cattle pastures, more especially for dairying, in addition to

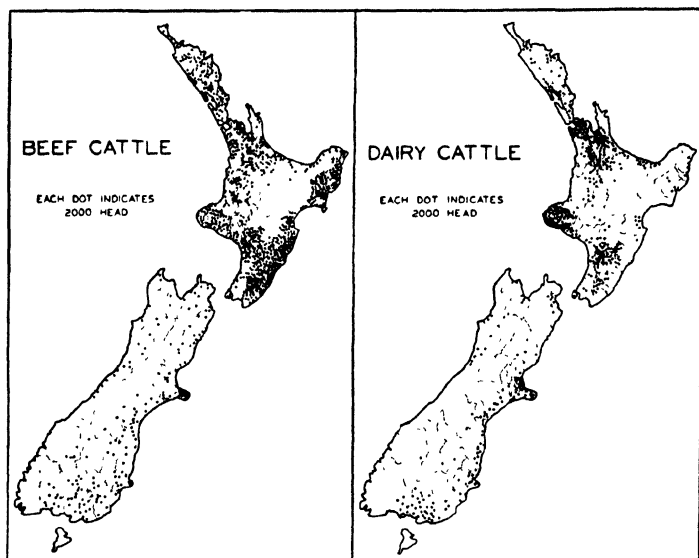


FIG. 92. Distribution of Beef and Dairy Cattle, N.Z.

sheep raising on the plains. On the other hand, the pastoralists of the South Island have given almost all their attention and energy to raising sheep, particularly fat lambs, for export to the United Kingdom. The numbers of sheep and cattle in New Zealand have been steadily increasing with the progress of settlement; but the advance, particularly in cattle numbers, has been very marked in the last decade. In 1946 there were in the Dominion about 34 million sheep, 4.7 million cattle, 750,000 pigs and, in addition, 216,000 horses.

3. *Population*

Few lands are so interesting in the human aspect as New Zealand. The explorers, whalers, and settlers of the early days found here a sturdy and capable race which had already advanced far in the arts and crafts of civilization. The



FIG. 93. A typical sheep station, Hawke's Bay, N.Z. Frozen mutton and lamb are second only to butter as New Zealand's valuable exports.

legends of the first tentative explorations leading about A.D. 1300 to the migration of the Great Fleet to Ao-Tea-Roa, or Long White Cloud, as the Maoris called the land, is a record of skill and seamanship unexcelled in the history of any race. But even more remarkable was the adaptation and adjustment by which this Polynesian people, accustomed to the warmer 'Hawaiki' away to the north, developed a

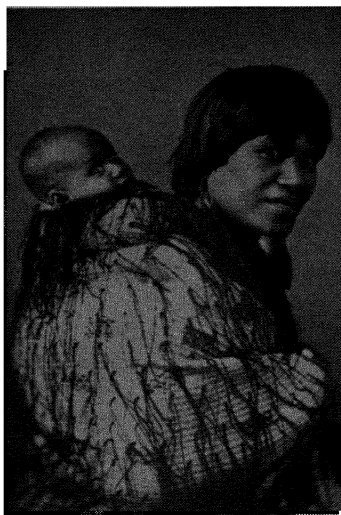


FIG. 94. Maori Types.

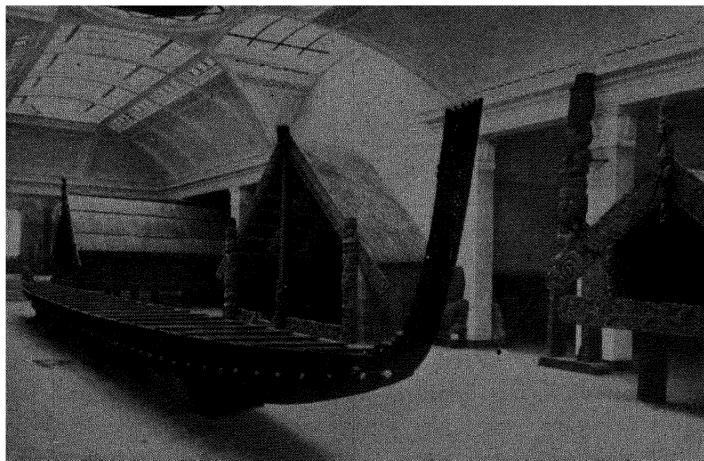


FIG. 95. MAORI WAR CANOE AND CARVED
HOUSE FRONTS

A Maori canoe captured in Manukau Harbour during the
Waikato War.

system of life that was far in advance of that of any other Polynesian race. Clothing, weapons, dwellings and agriculture all show the influence of a colder environment in developing energy and stamina.

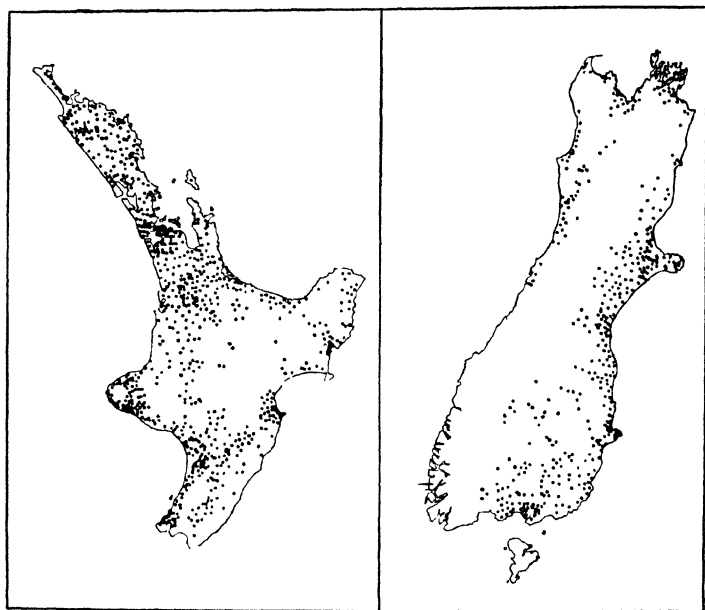


FIG. 96. Distribution of Population, N.Z.

Exclusive of city populations, each dot represents 100 people.

After the fierce clashes of the first contact between the natives and the newcomers had died down, Maori and European both realized that their common destiny needed co-operation rather than destructive competition; and the following years have been a wonderful demonstration of the ability of Polynesian and European to live in peace and mutual helpfulness. The Maoris, numbering about 88,000 (1939) are steadily increasing. The white population, an

unusually high sample of European stocks and mainly British, numbered slightly more than $1\frac{1}{2}$ million at the 1945 census. Maoris number about 100,000.

4. *Communications*

The roads and railway routes of the Dominion are determined by the disposition of the highland masses. Only at one place, i.e. between Christchurch and Greymouth on the west coast, and then by means of a long and expensive tunnel, does a railway break across the barrier of the Southern Alps; while the main trunk line for the South Island runs clear through the plains of Canterbury and Otago with many spur lines running back into the valleys cut by the streams. In the North Island the transport problem on land is somewhat easier, although very difficult grades occur on the main line from Wellington to Auckland which runs along the west side of the highlands. A second line from New Plymouth in the extreme west to Napier on the east cuts across the main trunk. Napier is also connected via Wairarapa Valley to Wellington. Branch lines to North Auckland and to the Thermal District complete the system at present, and a short detached line runs back inland from Gisborne. The sea routes, as for all islands, are more important than the land routes in respect to freight carried; and the chief lines of communication are the two trans-Pacific routes via Auckland and Wellington; the routes from Auckland, Wellington, and the Bluff to Australian ports; the ferry services between Wellington and South Island ports, especially Lyttelton; and the routes connecting the outlying ports.

5. *Industry and Trade*

The principal manufactures of the Dominion are connected with the processing of food and raw materials, e.g. flour-milling, tanning, and soap-making, or with the preparation

of wearing apparel or the assembling of machinery, although some textile and hardware factories of a more ambitious type exist. These manufactures and others of a 'local' type are centred in the four main cities.

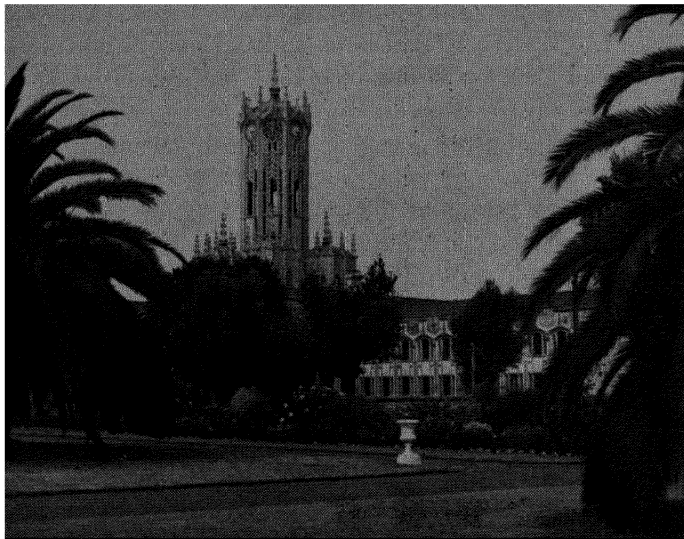


FIG. 97. University College, Auckland.

Auckland (265,000) is the largest city, situated on the very beautiful Waitemata Harbour. Its position in relation to the trans-Pacific routes and its railway connection with Wellington, the political capital, give Auckland a 'cross-roads' position that has been responsible for its commercial status. As the centre of a dairying, fruit, and timber-producing district Auckland has a steady flow of trade. It is also the collecting centre for the curious 'gum-digging'

industry of North Auckland, based on fossil gum from ancient kauri forests, which is much valued for varnishes. Gold production is still important but declining.

Wellington (175,000), the second manufacturing city and seat of the Government, is situated at the extreme south of the North Island on the magnificent land-locked harbour of Port Nicholson. A great deal of the importance of the city is due to its central position and to its command of routes in all directions by both land and sea, including the sea-route to Christchurch, which forms the chief connecting link between the two main islands.

Christchurch (150,000), in an extremely beautiful situation on the River Avon, is the natural capital of the rich Canterbury district. It exports through Port Lyttelton the meat, wool, wheat, and other products of the region. Its connection by coastal rail with the towns of *Oamaru*, *Timaru*, and *Ashburton*, and with the two big centres in the southern provinces, is a factor in its importance.

Dunedin (83,000) is the commercial and education centre for the southern end of the South Island, and the central point of a prosperous agricultural and pastoral district. It is connected by rail with Bluff, the port of *Invercargill* (27,600), the most southerly town, the first point of call for steamers from the west using the southern route.

Other important centres in the Dominion are: *Napier* (20,000), the main port for the sheep-farming district lying around Hawke's Bay. *Hastings*, about 20 miles farther south, is an inland pastoral centre. *New Plymouth* (21,000) is the chief port of the rich agricultural and dairying district of Taranaki and an important rail-head. *Palmerston North*, *Hamilton* and *Wanganui* (all about 27,000) are other collecting points for a great pastoral region which is also noted for the production of flax. *Hamilton* (18,000) has become an

important farming centre. *Rotorua* is the chief town of the Thermal Region, dependent largely on its attractions as a tourist resort and spa. *Nelson* (17,000) is the natural head

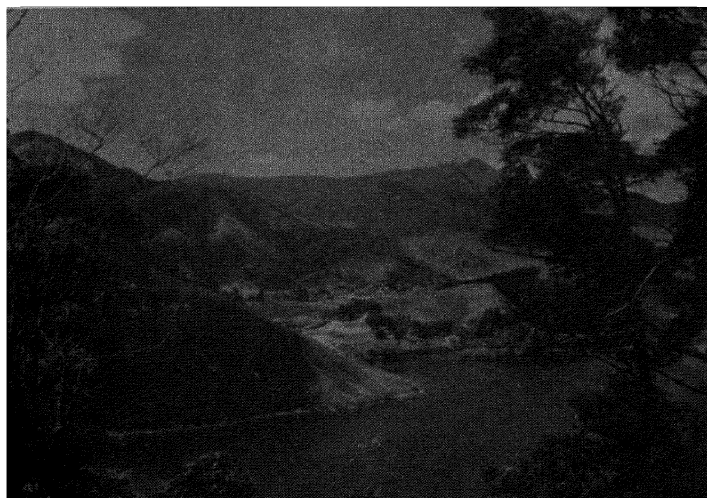


FIG. 98. Picton and Sounds, South Island, N.Z.

of the chief fruit-growing district of the Dominion at the north of the South Island, while *Blenheim* (6,000), is the port for the Marlborough pastoral district.

On the west coast of the South Island the small towns of *Westport* and *Greymouth* owe their importance to about 3,000,000 tons of excellent coal raised annually in the fields of the district. Deficiency in coal throughout the Dominion is compensated by the ample water-power available for generation of hydro-electricity. The largest generating stations are at Lake Coleridge near Christchurch; at Arapuni Rapids, on the Waikato River, which is one of a linked series of stations to supply power to the whole of the North Island; at Lake Waikaremoana; and at Mangahao, the chief source

of power for Wellington. Hydro-electric schemes are being extended.

The industries that bulk largest in the figures for the oversea trade of the Dominion are, of course, those that are dependent upon the pastures, viz. dairying and sheep-raising. More than 75 per cent. of the total exports is made up of the products of the grasslands. On the average values of exports for the last ten years, the percentages for the chief export items were: butter, 22; frozen and chilled



FIG. 99. The important Arapuni hydro-electric works in the North Island of New Zealand.

meats, 21; wool, 23; cheese, 8.5. The direction of exports and the sources of the bulk of imports are shown in the following table for the last six years; but the figures must be taken as approximate only:

NEW ZEALAND EXPORTS AND IMPORTS BY COUNTRIES

	<i>Exports</i>	<i>Imports</i>
Great Britain	75 per cent.	45 per cent.
United States	8 „ „	24 „ „
Australia	3 4 „ „	14 „ „

The importance of various kinds of activity in the economy of New Zealand is indicated by the valuation placed upon various kinds of production for the year 1945-46. The figures represent value in millions of pounds for different kinds of production estimated to be worth £200,000,000 in all for that year.

	£M.	Per cent. of Total
Pastoral	59	29 5
Dairying, Poultry and Bees	41	20 5
Agricultural	15	7 5
Mining	6	3 0
Forestry	6	3 0
Fisheries	1	.5
Factories	56	28 0
All other	16	8 0
	200	100 0

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PART V

THE PACIFIC ISLANDS

CHAPTER XX

THE CONTINENTAL ISLANDS: MELANESIA

IT is almost an impossibility in such a short account to give an adequate treatment of the great number and variety of islands scattered over the face of the Pacific. In the early chapters of this book there is much of a general nature that need not be repeated; but even so the task of including some description of the more important groups and of islands that range from the great areas like New Caledonia to tiny atolls is quite formidable. All that can be done is to select and describe typical areas. It may be said that the islands to be found in the Pacific fall into three classes: (i) the large continental islands or groups such as New Caledonia and the New Hebrides. In this class only those islands that are not more easily treated with continental regions have been chosen; (ii) the volcanic groups, such as Fiji and Hawaii; and (iii) the innumerable atolls of Polynesia and Micronesia.

Even with such a variety of soil and structure as is found throughout the islands there are resemblances in way of life, occupations, cultivation and even physical characteristics, which spring very largely from similarity of climate over this wide area. The economic plants, coco-nut, banana, taro, sugar cane, pineapple, to name only a few that find in these islands suitable conditions for their growth, have such an effect upon life and scenery in the South Seas that great similarity is inevitable.

On all the islands where volcanic action has been prominent

something of a sequence of surface may be regularly observed, and this, of course, does not refer solely to the mid-Pacific groups, but applies with equal truth to continental islands like Java and New Caledonia. The sequence runs somewhat in this way. At the sea-level are seen the beaches and sand-

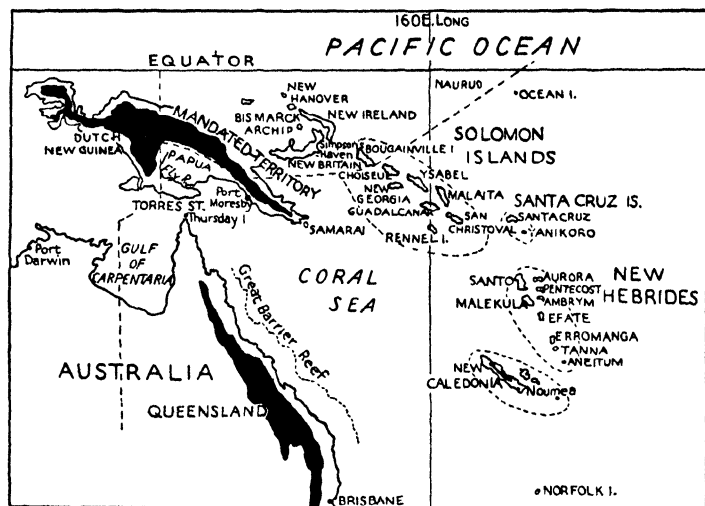


FIG. 100. New Guinea and Continental Islands.
Highlands shown black.

dunes or the coral-flats that are the result of the raising of a reef. These raised reefs gradually acquire a coating of soil and, in time, some vegetation, notably coco-nut palms. Behind the beach line are the coastal plains and alluvial areas built up by the streams descending from the interior slopes. Abutting on these lowland areas may be the steep ends of the lava flows, now presenting a sheer wall of cliff, or more sloping flow surfaces where the lava has flattened out on its way to the sea. Behind these again may be a high treeless

lava-plain that represents a recent flow level. The summits have often been carved away into the narrow, ridgy divides that make the irregular skylines of many volcanic islands. The accidents of geology and the work of erosion have combined to give to each island some character of its own.

Something can be said also about the uses to which man puts these different areas. The beach zone is of little use except for growing coco-nut palms, but the alluvial areas lying at the back are often the most fertile belts in the island. Here rice, taro, sugar-cane, and bananas are found almost invariably. Above these the pineapple finds a situation that suits it, but the steepest slopes are uncultivated. In these two belts a great variety of other fruits may be found, from the paw-paw on the flats to the guava and coffee on the higher levels. The uplands may be used for pasture, but the main life will be found between sea-level and 2,000 feet above it.

1. *New Caledonia*

One of the parallel submarine ridges which extend between New Guinea and the Auckland Peninsula emerges at about 20° south latitude to form the long island known as New Caledonia. This single area, 250 miles in length and 30-40 miles in breadth, is, after New Zealand, the largest of the truly Pacific islands. In structure, character of the plants and animals, and native inhabitants it is very closely connected with New Guinea. Both the eastern and western shores are fronted by continuous reefs; that on the western side is one long stretch for 400 miles, and is only second in length to the Great Barrier Reef. A confused mass of ranges rising to 5,000 feet runs the length of the island, and the numerous short rivers have gouged channels that make the surface very rugged.

New Caledonia offers a remarkable contrast to some of

the other islands, particularly the South Island of New Zealand and Tasmania. The main direction of the mountain ranges in New Caledonia, the grain of the country, is the same as that of the prevailing winds, i.e., the south-east Trades. As a consequence only the eastern and southern



FIG. 101. EAST COAST, NEW CALEDONIA

A typical view along the east coast of New Caledonia. Here, in contrast to the west coast, the mountains drop almost straight to the sea. Note the narrow coconut-palm fringed beach and the fringing reef (shown by the line of surf).

parts of the island are well watered, and many parts of the interior are almost desert-like. A feature of the landscape is the serrated appearance of the mountain ranges, which, because of erosion by the vigorous streams, appear to have no definite system. In contrast to most of the islands in the sub-tropical areas, New Caledonia is not heavily forested. Although great kauri forests do occur, much of the surface is grassland or covered with a light scrubby growth.

The average temperature is about 72° for the hot season (December-March) and 65° for the cool months (June-October). The extreme range is from 98° to 50°, and frosts are unknown. The climate is far less humid than that of most islands similarly situated, an effect of the arrangement of the mountains that has been mentioned. Rainfall varies greatly as between localities. Noumea, on the west side of the island, has a fall of about 40 inches a year; but 70 per cent. of this is concentrated in the hot months. In this season, too, storms of a cyclonic character—the dreaded hurricanes of the planters—frequently develop, and occasionally they move right across to the interior of Queensland.

The dark skins, frizzy hair, and decided features of the natives of New Caledonia indicate a very close connection, racially, with the natives of New Guinea, and a clear distinction from the natives of the islands of Polynesia and New Zealand. The decline in their numbers after the contact with the white man is most tragically marked. The French found a population estimated at 70,000 when they took over the territory in 1853; but the onset of European diseases, and changed ways of life, have diminished the numbers to about 25,000. Few of the natives of Pacific islands take kindly to the rigid hours of work during the day favoured by the white man. The native's own way of working in the cool of the morning and evening or, more often, when he feels inclined, and his preference for leisured ease during the heat scarcely fits the continuous programme of a plantation. The lack of inclination for such work on the part of the native has led, in New Caledonia as elsewhere, to the introduction of Asiatic labour. The French have imported numbers of Javanese and Tonkinese, mainly for work in the plantations and mines. This mixture of peoples brings with it many troubles in administration, and introduces also social

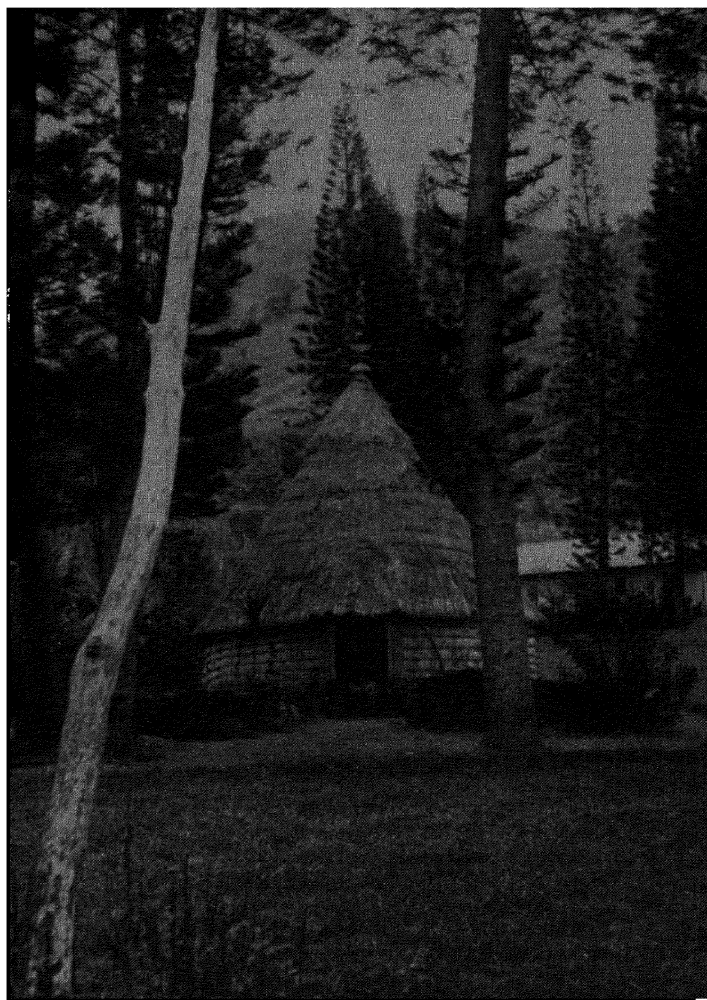


FIG. 102. Native Chief's Hut, New Caledonia.

problems of a very difficult nature. The island was originally a French penal settlement, and although transportation ceased about 1900, many of the present white population came as exiles. The white population numbers about 17,000.

New Caledonia is notable for the extent of its mineral wealth. This mountainous territory has proved deposits of



FIG. 103. THE BEACH AT NOUMEA, NEW CALEDONIA
Note the reef in the foreground and the characteristic trade-wind clouds.

chrome, cobalt, antimony, mercury, silver, lead, copper and many other minerals. Nickel, however, is the chief item in the catalogue. More than half the surface is too rugged for cultivation, but it is in these areas that the known and possible mineral resources exist. The valleys are very fertile but, owing to the lack of suitable labour, are undeveloped for the greater part. The land of the island is divided into three 'domains,' state lands, the penal settlements, and the

native reserves, but very little of the native portion is reasonably productive. The chief products for export are copra, coffee, cotton, minerals and maize. Others are hides, trochus shell, bêche-de-mer, sandalwood, and tropical fruit such as bananas. The bêche-de-mer or trepang is a 'sea-slug' about 10 inches long which is dried and exported to China. Sandalwood is esteemed because of its peculiar aroma, and finds a market also in China.

Nouméa is the chief port and seat of government, with a population of about 9,000 people. It is placed on an excellent harbour, well protected from storms. Imports come mainly from France and Australia, while exports are predominantly to France and to a lesser degree to U.S.A. A wireless station has been erected at Nouméa, and a cable connects *Téoudie* with Bundaberg in Queensland.

2. *The New Hebrides Islands*

Lying to the north of New Caledonia is the group known as the New Hebrides. These islands are of interest from many points of view. The origin and customs of the natives and their relation to the other peoples of the Pacific, the peculiar nature of the government of the group, and the geological history are all unusual in some respects. De Quiros in 1606 discovered the most northerly island of the group; and, in compliment to the reigning Archduke of Austria, gave the name *Terra Australia del Espiritu Santo* (Southern Land of the Holy Spirit) to the land that he mistakenly thought was the great southern continent. Captain Cook on his first long voyage of discovery in the Pacific was the next visitor. He explored the group and gave it its present name. The most important islands are Santo, Malekula, Aurora, Pentecost, and Efate, tapering from blocks of considerable size such as *Santo*, in the north,

75 miles by about 40 wide, to small but very productive islands like *Aneityum*, with a circumference of less than 40 miles. The whole group is very mountainous; but the elevations of nearly 6,000 feet in the north fall away to less than 3,000 in the south. Largely volcanic in formation, the islands carry soils of great fertility; and most of them sustain heavy forests. In parts, the volcanic rocks are overlain with raised coral terraces.

The climate is more nearly typical of the region than that of New Caledonia both for temperature and rainfall. Great variations in rainfall occur, but nothing like the aridity of parts of New Caledonia is found. The prevailing wind-direction, however, results in a pronounced difference between the vegetation of the east and south, where the Trades have their maximum rain-bearing effect and result in luxuriant vegetation, and that of the west and north where heavy growth is notably absent.

Just as the New Hebrides form a group in which the geological characters of the continental islands merge into those of Polynesia, so it forms a transitional area in the matter of population. A very interesting mixture of peoples and languages combines the characteristics of both the Melanesian and Polynesian peoples. In colour there is every variation from the sooty black, woolly-haired negrito type resembling the Papuan, to the taller, lighter-coloured Polynesian. It is claimed that at least twenty different languages are spoken by the 50,000 natives scattered through these islands.

The saddest page in the history of the Pacific turns on the visits of traders and whalers after 1800. To their outrageous treatment of the natives was added the horror of the slave trade known as 'blackbirding.' The natives, called generally 'kanakas,' were recruited by shameful methods for work on

plantations, particularly on the sugar plantations of Queensland. Added to this injury were the diseases introduced by the whites. It is not surprising that a great decline took place in the numbers of the natives, and that suspicion and distrust of the white man and his works became deeply rooted in the minds of the people.

The government of the group presents an unusual and not particularly happy experiment. By means of an agreement known as the Condominium Pact between the British Government, whose nationals first occupied the land, and the French Government, who claimed the island as a result of the proclamation of 1871, but had few settlers there, it was arranged to govern the islands jointly. The Pact reads: 'The group of the New Hebrides shall form a region of joint influence in which the subjects and citizens of the two Signatory Powers shall enjoy equal rights of residence, personal protection, and trade, each of the two Powers retaining jurisdiction over its subject or citizens, and neither exercising a separate control over the group.' The Joint Court, which is the chief instrument of the Condominium, is the place for the arbitration of the claims between French and British; but the interests of the natives tend to be lost sight of in the process of settling disputes between the whites. And there is no area which calls for single-minded administration in the interests of the native more than does that which is under the control of the Condominium.

Efate, one of the smaller southern islands, has two excellent harbours in *Vila* and *Havannah*, and, largely because of this, the seat of the dual Government is situated at Vila. As the headquarters of both the British and French officials, and the commercial centre for the southern part of the group, it has become the most important settlement. The corresponding hub for the northern section is at *Segond Channel* on

Santo. Malekula is the second largest island, with a large number of important plantations and some good harbours, the lack of which definitely hinders the development of some of its neighbours such as *Aurora*. The interior of both the large islands is largely unknown territory inhabited by wild tribes. *Malo* and *Aoba* are both very productive smaller islands, while *Tanna* and *Ambrym* are noted for possessing very active volcanoes. Parts of this coast have risen 60 feet since the visit of Captain Cook. *Ancityum*, an exceedingly productive spot, now has a population of a few hundreds in place of the 12,000 of fifty years ago.

3. *The Solomon Islands*

Structurally connected with the New Guinea mountain system, and generally volcanic in formation, the Solomon Group lies 10° nearer the equator than the New Hebrides. The group comprises very many islands of varying size but with an average area much larger than those of the New Hebrides. The two groups are alike in being arranged in double rows of summits belonging to partly submerged ranges. The chief members of the group are *Bougainville*—the largest, about 140 miles long by 35 wide—*Choiseul*, *Ysabel*, *Malaita*, *Guadalcanal*, *New Georgia* and *San Cristoval*. No other group has been so intimately connected with the exploration of the Pacific as the Solomons. The Spanish navigators, Mendana, De Quiros, and Torres, the French explorers Carteret, Bougainville, La Perouse, d'Urville, and D'Entrecasteaux, and many English sailors from Shortland to Hunter have had a share in the discoveries of these islands. The British Government declared a protectorate over the southern part of the group in 1893; and, with the exception of Bougainville and Buka, the group became entirely British when Germany handed them over by treaty in 1900.

The total area of the group is calculated to be 15,000 square miles spread over about 50,000 square miles of ocean. Elevations are intermediate between those of New Guinea and the lower heights of the New Hebrides; and peaks of 7,000-8,000 feet are known.

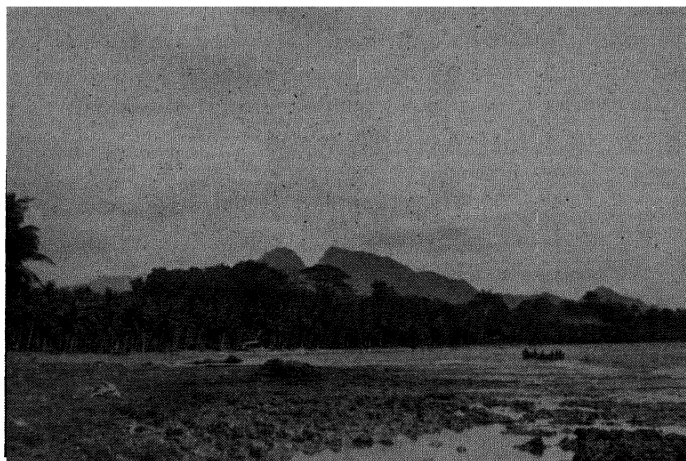


FIG. 104. GUADALCANAL

The reef-bound coast of Guadalcanal, in the Solomon Islands.

Its situation within 10° of the equator brings the group into the belt of equatorial calms in the hot season (November to March) and the climate in general is nearer the equatorial than the mid-Pacific type. The change of season occurs from April, when the south-east Trades move northward with the sun. The mean monthly temperature is monotonously high, being always in the neighbourhood of 80° F. This, together with the high humidity, emphasizes the equatorial character of the climate; and the region is not nearly so favourable for white settlement as the more southerly

islands. Malaria and dysentery, to name only the major troubles, are very prevalent, and the natives seem particularly susceptible to their ravages. The rainfall varies very greatly both in time and in amount, but the more settled parts are known to receive between 80 and 100 inches in the year.

Planting on a large scale has been a feature of the development since certain large soap-manufacturing firms decided that the Solomons were suited to copra production under the plantation system; and, since 1905, very large areas have been developed. The coco-nut palm comes into bearing six or seven years after planting. The nut is split and the white kernel when dried becomes the highly odorous copra of commerce. A native labourer will collect and split 300-400 pounds of 'green' copra in a day. This is then dried in kilns and the weight is reduced by about half. The main difficulty has been the provision of suitable labour: before World War II, 20,000 tons of copra had been exported each year.

Like the people of the New Hebrides the Solomon Islanders show signs of considerable racial mixture, although the Polynesian traits are only noticeable in the coastal districts. By nature fierce and suspicious, the native temper has not been improved by experience of western methods of approach; and the group presents one of the most difficult problems of administration in the Pacific. The difficulty is intensified by the bewildering jumble of languages and dialects. No less than forty different modes of speech have been traced in the group. The numbers of the native population are not known with any exactness, and the figures quoted from time to time are nothing more than skilful guesswork. Some islands are densely populated; *Malaita*, for instance, has at least 50,000 inhabitants and may well have twice that number, while some of the other islands are

equally populous. Only about 5,000 natives are working on the plantations. Depopulation is just as great a tragedy as in some of the other groups. Settlements that fifty years ago could number five thousand inhabitants each could not muster so many hundreds now. *Vanikoro*, in the Santa Cruz group, has less than 100 people in place of its former population of 3,000.

Tulagi, in a central position on a small island midway between Malaita and Guadalcanal, is the chief port and centre of government for the Solomons. Other ports, mainly for the collection of copra, are *Gizo*, *Faisi*, *Aola*, *Makira* and *Malaita*. Almost the whole of the copra production is exported to Sydney, although there is a growing trade connection with the United States.

CHAPTER XXI

THE VOLCANIC GROUPS OF THE MID-PACIFIC: POLYNESIA

AS the economic geography of these islands depends so directly upon their structure a brief description of their formation will be in order. Typically these islands have been

'built up by flow after flow of basaltic lava. These flows thin out as they leave the centre of eruption until a gigantic dome is built up above the sea. The diameter of such a dome may be ten to thirty miles at sea-level, and its height from a few thousand to over 13,000 feet. As a final stage of vulcanism several subsidiary volcanoes may break out on the slopes of the great dome and cinder cones be left as a result. Consequent streams, radiating out in all directions from the dome, would begin to dissect it as soon as it arose above the sea. . . . Corals may add their mite to the extension of the island and the reefs may be elevated to form land.' (Otis Freeman.)

This description of Hawaii holds good for most of these

volcanic groups, although they vary very much in age, and consequently in the degree to which the weather has affected them. The basalt weathers very easily, but where the flows are of recent origin, as in the case of Haleakala and Mauna Loa, the original dome-like profile is still preserved. Where

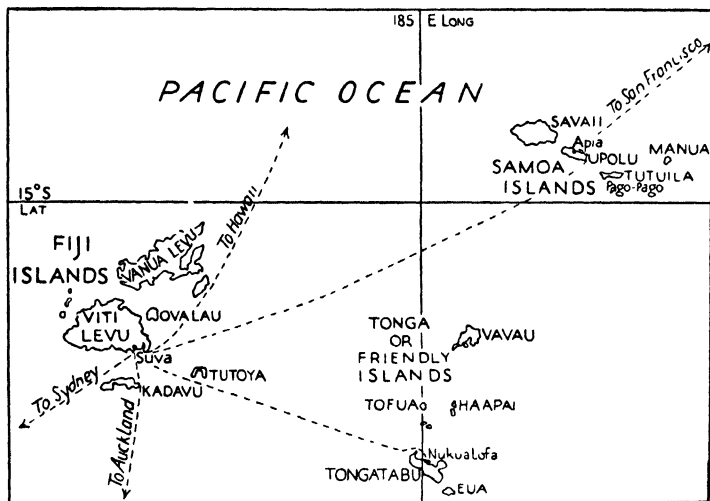


FIG. 105. Fiji, Tonga and Samoa.

erosion has gone further, and particularly in the case of ash cones, the old crater walls are broken down and serrated into most unusual shapes and outlines. The upstanding peaks and knife-like ridges of these regions form one of the wonders of the Pacific from Hawaii to Tahiti. Where the elevation has reached 3,000-5,000 feet in the trade-wind belt, the mountains enter the zone of maximum rain and very heavy annual falls are usual. Some importance attaches to this in consequence of the effects upon distribution of rainfall and upon stream flow in the islands.

1. *The Fiji Islands*

The Fiji Group, as we have already seen from the study of New Zealand, represents an unsubmerged portion of a mountain fold stretching under the sea for thousands of miles in a north-south direction. The structure of the islands is highly volcanic, although no activity is apparent in the group at the present time. There are about 150 islands in the group, all very mountainous, nearly all rimmed with reefs, of which about 90 are inhabited. The two main islands *Viti Levu* (Great Fiji) and *Vanua Levu* (Great Land) make up six-sevenths of the surface area, and support three-quarters of the population.

In nearly the same latitude as Fiji lie four other groups of very similar formation and production. These are *Tonga* (or Friendly Is.) and *Samoa* (or Navigator's Is.), about 400 miles to the south-east and north-west of Fiji respectively. Another 800 miles to the eastward are the relatively less important groups, with smaller and more scattered islands, known as the *Cook Is.* and *Society Is.* Nearly all are volcanic cones more or less broken down by weathering and ringed by coral reefs, are situated in the same climatic region, and peopled by similar stocks. Occupations and production are of a very similar nature throughout. Historically they are of great interest since the great Pacific explorers De Quiros, Tasman, and Cook made many contacts; and Cook in particular has a very intimate connection with most of them, as he has with Hawaii far to the north.

The chief features of the islands are the sharp and jagged outlines of the ancient crater walls and volcanic ridges, the dense vivid green vegetation stretching right from the water-line almost to the highest summits, and the abundance of vigorous streams. The seaward current of fresh water maintained by these rivers prevents the growth of reefs opposite their mouths, and consequently these breaks form

the chief entrances for shipping, while the reefs provide a natural breakwater.

The Fiji Islands are in the trade-wind belt of the south Pacific; and, as usual in such situations, they have a pronounced wet side. The climate is strictly of the mid-Pacific type, with the small annual range of temperature which is the result of insularity. The absolute minimum is about 63° F. and the absolute maximum only about 90° F., the mean daily temperature being about 78° F. Rain occurs throughout the year, but October to June are the months of heaviest fall. The amount varies considerably from place to place owing to the influence of the highland, and in any one year the amount and time of occurrence may vary a great deal from the normal. At Suva, the annual rainfall averages about 110 inches, but on the lee side of the mountains the total may be less than 60 inches. Another feature of the area is the occurrence of violent local storms of the hurricane type which, while not frequent, are exceedingly destructive.

The population of the group is now estimated to be about 206,000, composed principally of Fijians (100,000), Indians (over 83,000), Europeans (over 4,000) and Chinese (2,000). A true Melanesian, except in coastal areas where mixture has occurred, the native Fijian is distinguished by splendid physique, great intelligence and marked independence, and is intent on preserving the ancient customs and privileges of his race. The British Government allows the control of native affairs to be vested in the Fijians themselves as far as possible. Many of the Pacific groups have difficult problems because of the mixture of racial stocks that is taking place, in some cases with great rapidity. Fiji is one of such groups. The presence of the large Indian colony, which will doubtless soon outnumber the Fijians, is due to the need for labour upon the sugar plantations and in the mills of the island, a form of work for which the Fijian

displayed no liking. Political difficulties are appearing: the administration has been in the hands of the white settlers, but the Indians, now far superior numerically, are demanding active participation in the government. The Chinese group is formed of traders and merchants mainly interested in copra production.

The chief industry is, of course, agriculture of various kinds. Fiji has for many years been noted for the quality and size of its fruit, particularly bananas. Indeed, banana cultivation right through the mid-Pacific must be noted. Its value as a food plant is enormous; and one acre is calculated to produce over 30,000 pounds of fruit under favourable conditions, a far greater yield than is possible from any other crop. The growing of sugar-cane on a large scale, and of pine-apples, coco-nut, rubber, kapok, rice, and even tea and cocoa will afford some idea of the great variety of production, and the list is by no means complete. The refining of sugar close to the great plantations is the chief manufacture carried on in a large way. Gold mining assumed considerable importance after 1930. *Suva*, on a beautiful harbour, is the capital and chief commercial centre, forming a port of call on one of the main trans-Pacific routes, with sugar, bananas, and copra as the chief trade items. On the Rewa River, 12 miles away, a large sugar-mill is established. *Levuka* on the island of *Ovalau* is the chief collecting and export centre for the copra, while at *Lautoka*, situated in the chief sugar district of the group on *Viti Levu*, is another large sugar refinery.

2. *The Samoa or Navigator Islands*

This group is politically divided. Western Samoa, consisting of *Savaii* and *Upolu* with other islands, is administered by New Zealand under mandate from the United Nations;

while other islands to the east, of which *Tutuila* and *Mauna* are the chief, belong to the United States. The climate of the group is mild and equable, with little variation in the temperature from month to month, the mean being about 78° F. The prevailing winds are the south-east Trades, which in this region have a more marked easterly direction. These operate through the drier season from April to October. From October to April, the area comes more under the influence of the equatorial calms, bringing variable winds and periods of calm, and storms with heavy rain. As in Fiji, the presence of higher land affects the distribution of rain; and, since the prevailing winds are easterly, the west coast receives less rain than the east.

Cultivation is carried on both under the plantation system and by the natives on their smaller holdings. Coco-nut for copra is the staple of the group; but most of the tropical fruits are grown. The native agriculture is particularly connected with the growing of yams and taro; and bread-fruit, as in most of the islands, is prominent. The taro furnishes the chief food, and merits some further notice on account of its importance in native diet. The plant, with large leaves like those of a lily, grows mainly in rich mud, and develops a large tuberous root. In these islands it is pulled, the top cut and replanted, and the root cooked and used like a vegetable. In Hawaii and Fiji it becomes the basis of a starch food called *poi*.

The population of Western Samoa numbers 58,000 of whom 54,000 are native Samoans, and 400 are whites engaged in planting, administration, or trade. The Samoans are noted for their good looks, splendid physical development, and pleasant manners. They are true Polynesians, very closely allied to the Hawaiians in the north and the Maoris in the south; and many writers regard Samoa as the half-way house of the great migration from Hawaii to New

Zealand. By others it is regarded as the original home of the race and 'Savaii disputes with Hawaii the honour of being . . . the traditional Hawaiki whence the ancestors of the Maoris of New Zealand migrated to the great southern Islands. Both names—Savaii and Hawaii—would be pronounced Hawaiki by a Maori, but the word may have only a general meaning, like the word "home" in English.' The native pronunciation of Hawaii, it is worth noticing, is as near to Hawaiki as the English can render it, the *k* becoming a peculiar guttural click for which we have no symbol.

Upolu, the chief island, is so very beautiful in its alternation of mountain and smiling valley, forest and plain, that it is deservedly called the 'Paradise of the Pacific,' and Robert Louis Stevenson, the Tusitala or Teller of Tales to the Samoans, is immortally associated with the island. *Apia*, the capital of Western Samoa, is the chief settlement on the island, and is beautifully situated on a reef-protected bay. The whole island is about 500 square miles in extent, and *Apia* is the port for the copra which is the chief source of wealth. *Savaii*, the largest island, rising to summits of 4,000 feet, has an area of about 750 square miles. Its volcanic structure is of such recent origin, however, that it is far less fertile than its smaller neighbour.

Eastern or American Samoa has a total population of about 12,000. The island of *Tutuila*, about 24 miles long and 6 miles at its widest, is the most important of the group. It is a rugged mountain ridge with little level land, and that around the coast only. The Government is situated at *Pago-Pago* (usually pronounced Pango-Pango), remarkable as the interior of a partially submerged crater breached by the sea. 'About a mile from the harbour mouth it turns sharply to the westward, giving the harbour the appearance of the foot of a stocking with the United States naval station

situated in the instep, facing north and entirely sheltered from the seaward. The sea cannot be seen from ships at anchor inside the harbour, and ships lie quietly in smooth water during the heaviest gales.'

As in Western Samoa, there is little annual variation in temperature, and the pressure and wind systems resemble those already described. The rainiest season extends from December to March, and Pago-Pago receives an annual fall of nearly 200 inches; but there is a wide yearly variation between 130 inches (1905) and 284 inches (1908). Average monthly temperatures range from 79° F. to 82° F. Production is along the usual lines, and almost the only item of export is copra.

3. *The Tonga or Friendly Islands*

This is a group of about a hundred islands, varying greatly in size and structure and scattered over a wide expanse. The 'high' islands to the south are the remains of old volcanic peaks, and as the ridge runs northward the peaks are more and more submerged until they become low coral platforms almost at sea level, the 'low' islands. The three main sub-groups are known as *Tongatabu*, *Haapai*, and *Vavau* after the largest islands. Politically the group is very interesting as it is an independent monarchy under the protection of Great Britain. The population is about 33,000, of whom some 300 are whites mainly engaged in copra planting or trading. Copra is the main export; but the trade has been declining due to competition from other islands such as the Solomons. Until better drying arrangements are made, Tongan copra will continue to be regarded as of inferior quality. The other important export crop is bananas.

The capital, *Nukualofa*, is situated on the low-lying island of Tongatabu. The entrance is marked by the intricate

windings of the coral-reef, by the foam of the surf, and, in P. S. Allen's words, 'by the brilliant variegation of colour in the shoal water, the unusual contour of the low-lying coral islands with their beaches of yellow sand or fringe of dashing breakers, and by the novel character of the vegetation, indicated in the distance by the feathery heads of coconut palms silhouetted against the sky'; all very characteristic of the larger Pacific islands.

Among its comparatively few native plants is one of extraordinary interest, the 'sensitive mimosa.' It is a pest in its extent, but has delicate foliage and fluffy pink flowers. 'Brush its leaves ever so lightly and they shrivel up as with a blight, and if you walk where it forms a turf, your footsteps are marked by the shrinkage of its foliage. Its apparent blight, however, lasts only for a few minutes, and then it slowly expands and rises again.'

Ena, to the south, is a volcanic peak 1,000 feet high, while the *Haapai* group gains some interest from its connection with the mutiny of the *Bounty* in 1798. After leaving this group the crew set their commander, Bligh, adrift and he made a marvellous passage in an open boat to Batavia. Bligh afterwards became Governor of New South Wales and became the central figure of a rebellion in the colony, which resulted in his recall. *Vavau* is the most northerly of the main islands, and being of volcanic origin and mountainous, differs from the other two main groups, Tongatabu and Haapai, which are low-lying and of coral formation.

4. *The Cook Islands*

These form a widely scattered group of small islands, mostly volcanic in formation, of which the most fertile is *Rarotonga*. They are, politically, a dependency of New

Zealand. Raratonga is a much broken-down volcanic peak, rising abruptly to over 2,000 feet, and ringed by a coastal plain extending back into the interior in beautiful and fertile valleys. The circumference of the island is only about thirty miles, and the settled portion is a mere ring of cultivation

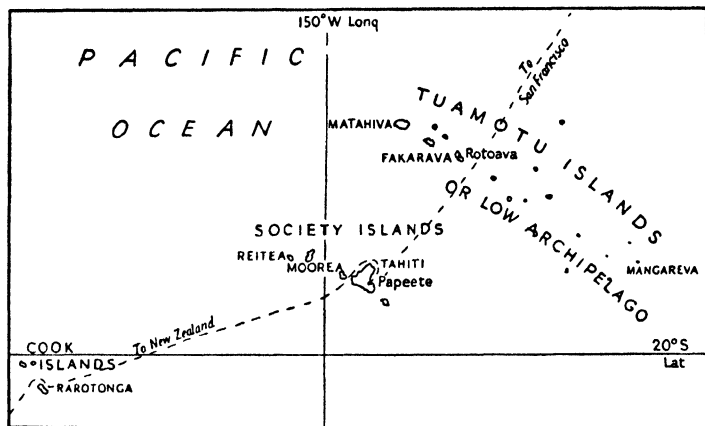


FIG. 106. Cook, Society and Tuamotu Islands.

round the coast. The island formerly had some importance as a port of call for mail steamers on the Auckland-San Francisco route; but there is no real harbour, and with the exception of small trading vessels which are able to pass the reef the ships lie out in the offing. Perhaps 8,000 people are engaged here, mostly in growing bananas, coco-nuts and oranges.

Mangaia is a larger but less fertile island with a remarkable raised reef like the rim of a hat, about a mile wide, along which the chief cultivation takes place. Taro swamps are the support of the small villages, but population has declined greatly. *Atui*, *Aitutaki*, and many others are all fertile spots, but the whole group is undeveloped. It is specially well-suited for the production of tropical fruits. At present, the chief exports are oranges, tomatoes and bananas.

5. *The Society Islands*

This cluster of eleven islands is in some respects better known than many of the other more extensive groups, doubtless owing to their position on the outer fringe of the volcanic area. The name that the group bears is another relic of the first great voyage of Captain Cook. It was to these islands that the scientific expedition sent out under his command by the Royal Society came to observe the transit of the planet Venus across the face of the sun in 1769. The old volcanic masses of which the islands are composed have been broken down by weathering into most unusual outlines even for islands of this formation. *Moorea Island* has razor-back ridges and needle peaks that outdo any alpine range for abruptness and for fantastic skylines. The rich soil that is a cause of the vivid and luxuriant vegetation in the islands is formed by the weathering of these ridges.

The largest island of the group, *Tahiti*, has a shore-line about 120 miles in length, behind which the land rises to a central block fringed like a tiara and known as the Diadem. Into this central mass deep valleys have been torn by the descending streams, and here is found in profusion almost every plant known in the sub-tropical Pacific. No other group has a more pleasant or more equable climate and Cook's own appreciation of the land may be quoted:

'Perhaps there is scarcely a spot in the universe that affords a more luxuriant prospect than the south-east part of Otaheite. The hills are high and steep, and in many places craggy; but they are covered to the very summit with trees and shrubs, in such a manner that the spectator can scarcely help thinking that the very rocks possess the property of producing and supporting their verdant clothing . . . and that no place on earth can outdo this in the strength and beauty of vegetation.'

The other islands are neither so large nor so suited for

settlement, but they are, nevertheless, all very fertile. The chief of them are *Mehetia*, *Moorea*, *Huahine*, *Raiatea*, and *Borabora*; but all, with the exception of *Huahine*, lack good harbours. The whole group is administered as a French dependency. *Tahiti* itself has a mixed population of about 20,000 people. Perhaps no Pacific islanders show the effects of the impact of 'civilization' so badly as the people of this group. Originally a splendidly developed and capable race, they have deteriorated greatly through the effects of diseases introduced by the newcomers. Their recovery has not been assisted by the introduction of Chinese, who now, through their hold on the trade of the islands, largely control the fortunes of the natives.

Papeete, beautifully placed upon a reef-protected harbour, is the chief port and centre of administration. As the first island of any importance on the route from San Francisco to Australia, it was a regular place of call for mail steamers. Since the occupations of the people are wholly agricultural—coco-nuts, taro, oranges, sugar, vanilla-beans are all produced in some quantity—very little systematic planting has taken place. The chief industries are the production of copra, sugar and rum, and the chief exports are copra and phosphates.

6. *The Hawaiian Islands*

Almost midway between Asia and America along the Tropic of Cancer and 'extending in a curve from north-west to south-east, there is an elongated submarine platform nearly 2,000 miles long, presumably built up by submarine lava flows.' Parts of this plateau, however, rise above the ocean surface. At the northern end a few scattered peaks, of which Midway Island is one, rise from the water; and a similar group occurs at about the centre. For the greater

part these are uninhabited and useless; but, at the southern end, the platform has been heaved above the water in a series of great lava domes that now form the Hawaiian Islands. Volcanic activity is still prominent in *Hawaii*, the largest, highest, and most southerly island of the group, which consists of eight large islands and a number of smaller rocky peaks. The average elevation of the group is over a

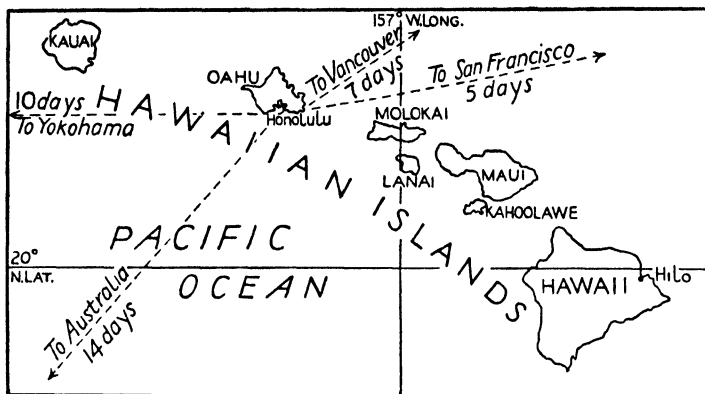


FIG. 107. Hawaiian Islands.

thousand feet, while Mauna Loa on the island of Hawaii rises to a summit nearly 14,000 feet above the sea. The eight inhabited islands cover over 6,000 square miles, and form a 'territory' under the government of the United States. *Oahu*, towards the centre of the group, with half the people of the territory, is economically the most important island.

Like Fiji, Hawaii is in the trade-wind belt, and enjoys a very similar climate. Average temperature throughout the year is between 70° and 72°, and there is only a difference of 5°-8° between the averages of the warmest and the coolest

months. The chief variation in temperature in the islands is due to elevation, and both Mauna Loa and Mauna Kea are snow-capped at times. The constant winds from the north-east have a high moisture content; and, as the main trend of the islands is at right angles to the wind-direction, both islands have pronounced wet and dry sides. The rainfall maps for Oahu and Maui bring this out particularly well. On almost any day the trade-wind moisture can be seen on the windward side of Oahu condensing as it is forced upwards over the sheer cliff called the Pali, and wreathing the mountain top in constant cloud as it drenches the cliff walls. Some moisture, carried over to the dry side, falls intermittently as the lightest of misty rains—the 'liquid sunshine' of Honolulu. Although the destructive hurricanes which occasionally molest the islands to the south do not blow in the Hawaiian Islands, strong cyclonic storms known as 'konas' sometimes reverse the usual order of things and bring rain to the southern slopes. In general, the rain tends to fall more in the cooler than in the hotter months.

A marked effect of the lop-sided rainfall is the control which it exerts upon agriculture. As a rule the northerly slopes are too wet for cultivation, and most of the agriculture is carried out on the southerly slopes. To enable the cultivation of the dry side, however, most of the lowland crops have to be irrigated. The underlying basalt layers in these islands are fortunately as porous as a sponge, and they store great quantities of water that become available by boring and pumping. Very expensive schemes for tapping this artesian water, and for bringing water from the west side through the hills by flumes, pipes and tunnels, have been carried out.

The chief industries depend on the cultivation of sugarcane and pineapples. The lowland plains, covered for miles

in every direction with an unbroken expanse of green canes, and the regular lines of the pineapple plantations on the higher slopes in the background, are the most striking features of the landscape in the agricultural areas. The

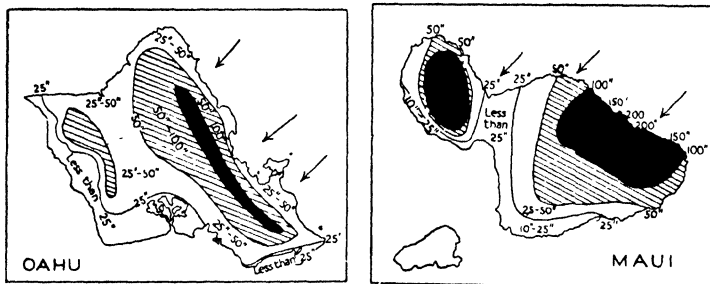


FIG. 108. Rainfall—Oahu and Maui (after Freeman).

cultivation of these two plants is the basis of the Hawaiian economy, as they also give rise to the chief secondary industries—the canning of pineapples and the manufacture of canned pineapple juice, the refining of sugar and the manufacture of insulating board from the fibre. Plantation methods have been very highly developed; and the efficiency of the two main industries, from the raising of the best sugar-cane and pineapple types, through the methods of cultivation and fighting of diseases and pests, to the cutting, handling, transporting, and the final stages of refining or canning, has set a standard for the world. Nearly a million tons of sugar are exported every year, mainly to the United States; and this crop is almost wholly produced on four islands, viz., *Hawaii*, *Oahu*, *Maui* and *Kauai*. Most of the plantations have their own crushing and refining mills; altogether in the islands there are about fifty plantations and over forty sugar-mills.

Sugar-planting on a large scale is limited by the available water. A single large plantation will drink a hundred million gallons of water in a day, or more than the average summer-day consumption of a city like Melbourne or Sydney. Every ton of sugar produced requires the provision of not less than 4,000 tons of water. Pineapples, on the other hand, favour the drier slopes, and 20 to 30 inches of rain will suffice for their growth.

Nearly half the total area of the Territory could be cultivated, but only about one-sixth is so used because its use as pasture for beef-cattle is more profitable. The sixth of the total area is mainly planted to sugar-cane and pineapples,



FIG. 109. Pineapple Planting in Hawaii.

in a ratio of about 3 acres to one, respectively. About one-fourth of the whole area is forested, and much forest land is licensed for grazing. On the average 235,000 acres of plantation are under sugar-cane and 80,000 in pineapples.

Among the main problems now being tackled are the conversion of pasture to crops, prevention of erosion, especially on the dry leeward slopes, soil conservation, and the substitution of sprinkler systems for channel irrigation. The longest plans for extending irrigation are on the islands of Hawaii and Molokai.

Other crops of importance, but coming a long way behind sugar-cane and pineapples, are rice and taro, grown on the swamp flats, and bananas and coffee from the better drained slopes, and a host of other cultivated plants such as paw-paw, coco-nuts, sisal, tobacco, and citrus fruits.

The Hawaiians are a true Polynesian type very closely allied to the Maori and Samoan. All three display the same characteristics, such as splendid physique and skill as fighters and sailors, generosity, and love of music and pleasure. The natives of Hawaii have adopted western ideas as successfully as the Maoris have, and are usually well-educated and excellent talkers and singers. Such a number of racial strains have, however, been introduced into Hawaii in connection with the agricultural activities that Japanese, Chinese, Koreans, Filipinos, Samoans, negroes, and Portuguese and other white stocks mingle inextricably in the business and social life of the island.

Honolulu, as the most completely equipped port in the mid-Pacific, has become the cross-roads, so to speak, where the routes from Asia to America and from Australia and New Zealand to Canada meet. It is, in addition, heavily fortified; and eight miles away is the splendid natural basin of *Pearl Harbour*, the great United States naval base in the north Pacific, the bombing of which by the Japanese on December 7th, 1941, brought the full fury of world war into the Pacific. As the centre of the sugar and pineapple industries, Honolulu has developed an important trade; and, in

addition, it has acquired a reputation as a holiday resort that attracts numbers of tourists. The city is the home of the territorial government, and several important institutions have been established here for permanent study of the problems of the Pacific. *Hilo*, the port of the island of Hawaii, and second in order of trade, has no natural harbour. An expensive breakwater protects shipping. Hilo is the gateway to the volcanic region; and *Kilauea*, the world's greatest active volcano, is thirty miles away. The last portion of the road crosses the old lava floor of the main crater, and passes by the edge of a great lake of molten lava, where an observation station is maintained by the Government for the purpose of studying the varying phases of volcanic activity. *Haleakala* on the island of Maui presents a contrast since it is extinct. With a crater of 20 miles across and 2,500 feet down to the main floor, with its myriad cinder cones 600-800 feet in height, and with the crater rim 10,000 feet above the level of the ocean, it is a giant among volcanoes. *Kahaului* is the chief port of the island of Maui; like all the other ports except Pearl Harbour, it is mainly artificial.

7. *The Pelew and Caroline Islands*

Lying about 700 miles to the north, and roughly parallel to the New Guinea-Solomons line, is a chain of island clusters about 1,600 miles in extreme length from east to west. For the greater part volcanic, they become smaller and more coralline in character towards the eastern end. Most of the islands are densely wooded. Politically these islands, together with the Marshall group, form one unit. Before 1914, they were all German possessions, but after the war they were administered by Japan under a League of Nations mandate. They are now under United Nations Trusteeship.

(i) *The Pelew Islands*. This is the most westerly group and comprises about 200 islands, of which *Palau Island* is the largest and most productive. A neighbouring island, *Angaur*, has important phosphate deposits, and the chief exports other than this are copra, turtle-shell, and bêche-de-mer. The typical trade-wind climate enables tropical fruits to be grown extensively. The population is about one-tenth of the former total of 50,000.

(ii) *The Carolines*. This group of 400 islands is arranged in clusters like the bunches of a vine. The *Yap*, *Ponape*, *Mortlock* and *Kusaie* sub-groups are the most important. Very little need be said since the life and occupations in these islands follow very closely along the lines already sketched for other groups. But *Ponape* and *Lele* have more than usual interest on account of the ruined cities left by a former civilization. That on the island of Ponape, because of its situation, with the sea ebbing and flowing in its deserted streets, has been called the 'Venice of the Pacific.' The massive stone foundations that still stand like long sea-walls show clearly the plan of this mystery city of the North Pacific.

Something further should be said of the rocky but productive island of Yap, which lies about 300 miles to the north-east. The islands of this sub-group have proved wonderfully productive; and here, too, are found the relics of a highly developed people in the shape of buildings and roads upon the origin of which research has so far thrown very little light. *Kusaie* is a mountainous and fertile island of which the chief port is *Lele*, a splendid harbour and notable for its colossal remains of ancient buildings.

8. *The Marianne Islands*

The transition from the volcanic to the coralline formations is shown very clearly in this group which extends along the

edge of the volcanic belt. Arranged in a north-to-south festoon, rather than in a cluster, the score of islands comprising the group taper in size from *Guam*, the most southerly member. They are all ringed with reefs, and some of the northerly islands are merely the summits of active volcanoes. This group, discovered by Magellan and named the Islands of Lateen Sails was renamed the *Ladrones* (Thieves) and still later named again after Maria, wife of Philip IV.

The people exhibit a considerable mixture of native, Chinese and Japanese strains; and the natives themselves seem to be part Filipino and part Spanish. Estimates of the population made in 1670 placed the number at about 100,000; but so serious did the contact with other races prove that within fifty years under 1,000 remained. There are now between 4,000 and 5,000 natives in the islands. The chief products are copra, coco-nut oil and sugar, mainly exported through *Apra*, the port of Guam which is a dependency of the United States.

9. *The Marquesas Islands*

This group lies to the north-east of Tahiti, and to the north of the Tuamotu Islands. Volcanic and rugged, the peaks rise to more than 3,000 feet. The islands form an exception in that coral reefs are rare. They constitute a French possession, and the tragedy of depopulation has reached its climax here. A beautiful and fertile homeland that half a century ago supported a magnificent race of 50,000 people now shelters less than a tenth of that number. *Nukahiva* and *Hiva-oo* are the chief islands, the ports of which are *Atuona* and *Tai-o-hae* respectively. These islands were named by the great Spanish explorer Mendaña after his friend the Marquis of Mendoza.

CHAPTER XXII

ATOLLS AND OTHER ISLANDS: MICRONESIA

NOTHING about the Pacific captures the imagination of youth and age so readily as the desert island of fiction—the atoll in actual fact. And equally nothing is more disappointing in the reality of closer acquaintance. No more monotonous life or restricted outlook can be imagined than that on those sandy shelves perched just above the level of the surf. An element of excitement which is not so attractive on the spot is added by the chance of being swept into the deep by tidal wave or hurricane at any time. The origin and general formation of the atoll has already been sketched, but there is perhaps need for more colour in the picture. Atolls consist usually of

‘coral belts, frequently not more than a mile wide, or even less, of a circular, oval or even triangular form, enclosing in the majority of cases a central lagoon with an entrance on the side opposite to the direction of the prevailing trade wind. These passages are in some instances navigable for vessels of large tonnage; in others they consist of a mere depression in the surface of the reef sufficient to enable the natives to paddle their fishing canoes in and out of the lagoon at high tide. The lagoons themselves are generally shallow, though in some places they exhibit vast hollows with an apparent depth of 50 or more fathoms. Their appearance is most extraordinary and beautiful; the water, from the absence of the debris of streams or any kind of alluvium, exhibits so surprising a transparency that an object of the size of a man’s hand may in calm weather be distinctly seen at a depth of 60 fathoms. The aspect of the bottom is that of a wilderness of marine vegetation of the most wonderful forms and gorgeous colours, seeming in some places to be spread over the surfaces of the sloping hills, in others to be growing out from the sides of tall pillars or towers pierced with vast caves in which the refracted beams of the sunshine cause the water to glow with the colours of the opal, and the innumerable species of zoophytes



FIG. 110. AIRMAN'S VIEW OF BERU, GILBERT ISLANDS
Note the actual atoll (dark), the reef and lagoon (light) and the typical
fleecy trade-wind clouds.

to glisten like gems, while between the huge caverned masses are wide spaces floored with sand, perfectly level and white as snow, upon which the great green mounds covered with coral trees throw fantastic shadows so that in leaning over the side of the canoe one cannot escape being reminded of the fabled grove of Aladdin.'

And in and out, up and down the waterways of the submarine landscape thus painted by Stevenson hover and swim and dart the fantastic shapes and indescribable colours of the finny inhabitants.

But not for us the environment of the mermaid. The life on the sandy stretches above this fairyland concerns us more nearly. As R. L. Stevenson describes in *In the South Seas*,

'the atoll is a discomfortable home. There are some, and these probably ancient, where a deep soil has formed and the most valuable fruit-trees prosper. I have walked in one, with equal admiration and surprise, through a forest of huge breadfruits, eating bananas and stumbling among taro as I went. This was in the atoll of *Namorik* in the Marshall group, and stands alone in my experience. To give the opposite extreme, which is yet far more near the average, I will describe the soil and productions of *Fakarava*. The surface of that narrow strip is for the more part of broken coral limestone, like volcanic clinkers, and excruciating to the naked foot. . . . Here and there you come upon a bank of sand, exceeding fine and white, and these parts are the least productive. The plants (such as they are) spring from and love the broken coral, whence they grow with that wonderful verdance that makes the beauty of the atoll from the sea. The coco-palm in particular luxuriates in that stern *solum*, striking down his roots to the brackish, percolated water, and bearing his green head in the wind with every evidence of health and pleasure. The pandanus comes next in importance, being also a food tree; and he, too, does bravely. . . . A green bush called "miki" runs everywhere . . . the whole number of plants on an atoll such as *Fakarava* will scarce exceed, even if it reaches to, one score. Not a blade of grass appears; not a grain of humus, save when a sack or two has been imported to make the semblance of a garden. . . . The land crab may be seen scuttling to his hole, and at night the rats besiege the houses and the artificial gardens. The crab is good eating; possibly

so is the rat; I have not tried. Pandanus fruit is made, in the Gilberts, into an agreeable sweet-meat, such as a man may trifle with at the end of a long dinner; for a substantial meal I have no use for it. The rest of the food supply, in a destitute atoll such as Fakarava, can be summed up in the favourite jest of the Archipelago—coconut beefsteak. Coconut green, coconut ripe, coconut germinated; coconut



FIG. 111. OUTER SIDE OF CORAL ISLAND

Rough, rocky beach littered with fragments of coral tossed up by the surf.

to eat and coconut to drink; coconut raw and cooked; coconut hot and cold—such is the bill of fare.'

The picture may be disappointing, but Stevenson has painted the sober truth of the monotony of life on the coral isle even in these days of infinite variety in the preparation of tinned foods; for the ship with supplies to spare may not happen to visit it once in a term of years.

1. *The Marshall Islands*

Arranged in a double row between 5° and 15° north of the equator, stretches this group of about thirty islands, none of which is much more than ten feet above the level of the ocean. Scattered over these coral rings are 10,000 natives of a Polynesian type with a distinct Asiatic admixture. These are occupied mainly in growing coco-nuts, pandanus, and breadfruit. Here the atoll formation is found in perfection. *Kwateleue*, a wreath of islets a hundred miles across, probably preserves the outline of some giant crater and is the largest atoll existing. Many of the smaller atolls are a perfect unbroken ring, with an outlet from the enclosed lagoon, so that the tide rises and falls through the underlying coral foundation. Of the pandanus or screw-palm a word may be said because of its importance in the scheme of life upon the atolls. It is almost as useful a tree as the coco-nut palm, and it fills almost every need of the islander. The fruit provides him with food, the wood with timber, the leaves with thatch for his hut or wicker for his basket, and the root a dye for the primitive clothes he, or rather she, wears.

2. *The Gilbert and Ellice Islands*

The *Gilberts* sit right on the equator, and are composed of very small atolls of hard coral and scanty limestone soil which, nevertheless, support about 26,000 people. The *Ellice Islands*, 400 miles to the south, are a similar group, which, however, support only some 4,000 inhabitants. The temperature varies very little from month to month, and the normal rainfall amounts to anything from 150 to 180 inches, but drought years in which an extremely low rainfall is received are not uncommon. Together with *Ocean Island*, *Christmas Island*, *Fanning Island* and *Washington Island*, these islands form a British colony administered from London. The *Phoenix* group was added to the colony in 1927.

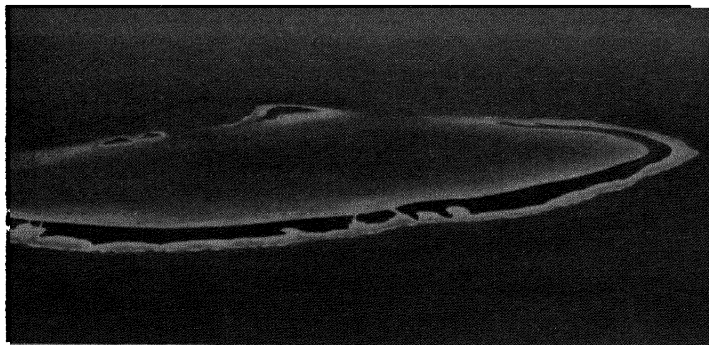


FIG. 112. ABEMAMA, GILBERT ISLANDS

A typical atoll showing white collar of reef and islets on far side.

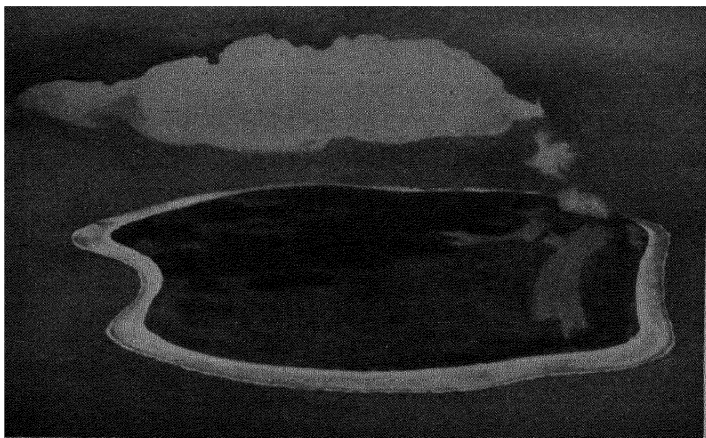


FIG. 113. NAURU, AN ELEVATED CORAL ISLAND

Nauru is $2\frac{1}{2}$ to $3\frac{1}{2}$ miles across and is one of the world's main sources of phosphatic rock. Australian soils are deficient in phosphates. Notice the air-strip on the site of old phosphate diggings.

The British Phosphate Commission works the deposits on Ocean Island, and also those on Nauru, which is administered by the British Empire under mandate from the United Nations.

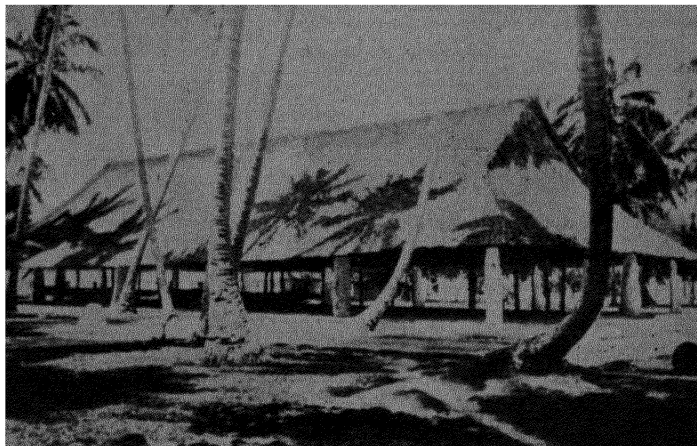


FIG. 114. NATIVE MEETING-HOUSE

This maneaba or communal centre is in the Gilbert Islands and measures 150 by 80 feet. Coconut and pandanus logs and thatch are the materials of construction. Mats are laid over the coral floor.

3. *The Tuamotu Group*

Often wrongly called the Paumotu Islands, this great group of nearly a hundred islands, scattered over more than a thousand miles of the central Pacific, is the greatest collection of atolls in the Pacific. Because of the treacherous currents which sweep through the group, currents which change and swerve in a most bewildering fashion, it has deservedly gained the name of the Dangerous Archipelago;

and an alternative that needs no explanation is the name of Low Archipelago. As P. S. Allen describes them,

'They are all of similar character and exhibit very great sameness in their features. When they are seen at a distance, which cannot be great on account of their lowness, the aspect is one of surpassing beauty if the dry part of the island or belt be sufficiently covered with trees; but much of this beauty is dispelled on a nearer approach as the vegetation is usually found to be scanty and wiry.'

The islands rarely exceed 30 feet above the sea, and the chief plants of importance, as on all atolls, are the coco-nut and pandanus.

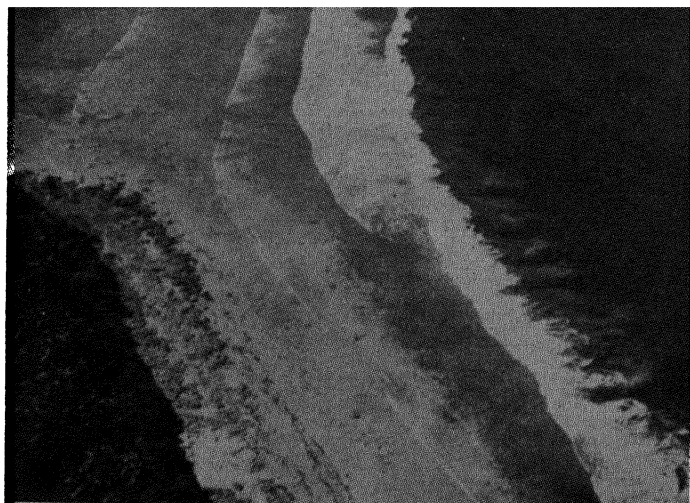


FIG. 115. SECTION OF CORAL REEF AND BEACH
Coral islet (shown black); coral fragments (broken); reef (light); surf breaking on reef (white); and deep water (black).

The chief industry is that of fishing for pearls and pearl shell, but owing to the danger of exhausting the banks the

'take' is carefully controlled. This legislation does not prevent a considerable amount of illicit fishing. Many of the shell beds were over-exploited and are now exhausted. The total export of mother-of-pearl shell from French Oceania before 1940 amounted to some 300 tons annually.

The Tuamotus are a French dependency governed from Tahiti. *Makatea*, a great bench of coral thrust 350 feet out of the ocean, has a notable phosphate deposit. A southerly group, the Gambier Islands, is unusual in this locality for its structure, which is that of exposed portions of a submarine ridge rising to sharp, reef-encircled peaks. *Mangareva* is the chief of the group, while *Fakarava* is the largest island in the Tuamotu section.

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ACKNOWLEDGMENT

Note.—The two extracts from the works of R. L. Stevenson on pp. 247 and 248 are reprinted by kind permission of Mr. Lloyd Osbourne.

PART VI

ASIA

CHAPTER XXIII

THE PHILIPPINE ISLANDS

THIS big group occupies such an important position in the north Pacific that it calls for more special treatment. Situated between 5° and 22° north of the equator, it comprises a rich and undeveloped area capable of producing every tropical commodity. The Philippines, formerly under the control of U.S.A., were granted independence in 1947 and now form a republic. This group is an under-populated area containing about 15,000,000 people lying close to Japan, China, and India containing about 850,000,000. Again, its position with respect to Japan, China, and Australia gives it a high strategic importance. The racial and religious mixture which is found in the group makes it one of the 'areas of ferment' in the Pacific. Lastly, Filipino independence has stirred other Asian peoples to demand self-government; and for these and other reasons, the Philippines has become a highly important region.

The Philippines have considerable mineral wealth. Gold mining is actively carried on in Luzon and Masbate; chromite, silver-lead, iron-ore, sulphur, mercury and coal deposits are known, and copper is widely distributed. These deposits are undeveloped because transport facilities are still lacking.

The 7,000 islands and islets of the group cover a total area of about 114,000 square miles, a little less than the area of the British Isles, larger than Victoria and smaller than California. Only about one-third of these islands, however, are habitable, the rest being mere rock peaks affording no foot-



FIG 116. The Philippine Islands.

hold for settlement. A dozen of the islands, of which the chief are *Luzon* and *Mindanao*, hold over 90 per cent. of the population of the group.

The Philippines are part of the Asiatic land-mass detached by the great subsidence which was mentioned in an earlier chapter. This sinking was accompanied by intense volcanic activity which is still vigorous; and most of the soils derive from broken-down lava. Many volcanoes are still active and in some cases are close to settled areas, while many have broken into violent eruption in the last fifty years. Naturally the whole group is subject to severe earthquakes. The trend of the mountain system is mainly north-south; and, although the surface is extremely rugged, few of the peaks exceed 8,000 feet. The larger islands have important rivers, a few of which are over 300 miles in length and useful as waterways. The alluvial valley floors are very fertile, and this largely explains the distribution of people through the group.

Climatic regions are not nearly so definite as on the mainland, or in the neighbouring large islands. The chief influences are the southerly monsoon which operates roughly from June to December, and the north-east trade-winds which blow for most of the remaining months. The average monthly temperature varies very little throughout the group and ranges from about 78° to 84° F. Three rainfall regions can be broadly marked, and these are reflected in forest, pastoral and agricultural conditions: (i) The eastern side of the group which receives rain throughout the year, in summer from the southerly monsoon and in winter from the trade winds. There is a marked winter maximum since this side of the islands is fully exposed to the north-east trades. (ii) The western side, in which the wet and dry seasons are sharply distinguished, the wet lasting from June to November during the period of the modified south-west monsoon.

The remaining months are dry because the trades are off-shore. (iii) The middle regions between these two areas, being of the overlap of both, but in general receiving a



FIG. 117. THE MIRACLE OF THE TERRACES

Rice fields in Ifugao, a Philippine mountain province. The effort to conserve the soil which has gone on for hundreds of years puts relatively small precautions, like contour ploughing, into the shade.

lower rainfall than either. In addition, and blurring the clear-cut divisions here made, violent cyclonic storms are likely to cause heavy falls anywhere at almost any time of the year.

The various types of agriculture practised in the islands follow these rainfall regions very closely; but of the total area only about one-tenth is farmed, although three times

that area is capable of intensive development. More than half the surface is still covered with forest, some 25 per cent. is grass land, and about 13 per cent. is cultivated.



FIG. 118. GROWING ROPES,
MINDANAO, PHILIPPINES

Abacà, the plant from which Philip-
pines "manila hemp" is obtained.

Rice is grown widely, but is heavily concentrated in those regions having pronounced wet and dry seasons. In some regions with the aid of irrigation, and in others where the rainfall is more evenly distributed, two crops a year are taken off the land. Despite this, the Philippines have been importers of rice for many years. Of recent years imports

have declined partly because of an expansion of domestic rice production and partly because to some extent the Filipinos are turning to other foods. Even so, the area under

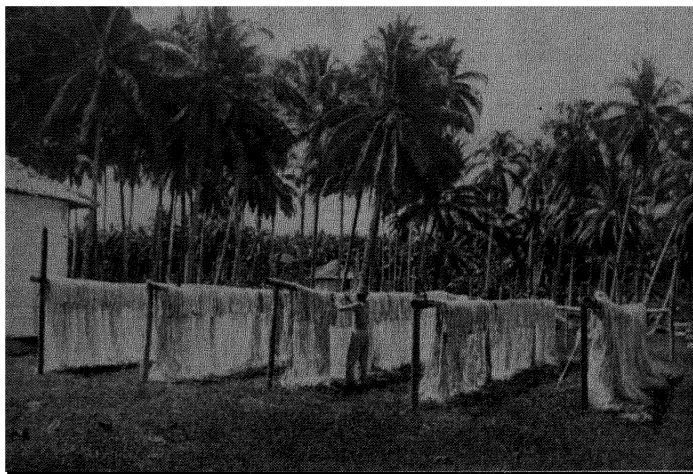


FIG. 119. HEMP DRYING

Racks for drying the hemp fibre against a background of coconut palms and abacá plantation. The world's best ropes are made from manila hemp.

rice could still be greatly extended; and the government has sponsored settlement schemes for this purpose. Rice is the most important crop, but maize is also largely grown, especially in the smaller central islands such as Cebu.

Abaca, the Filipino name for a species of banana native to the Philippines, finds the most favourable conditions in the south and east. Its leaf yields a fibre, 'Manila hemp,' especially valuable for rope-making on account of its durability and strength. The plant is grown both under plantation conditions and in the 'gardens' of the Filipino cultivators, and is exported normally to the value of £2,500,000 a year.

If all its products are counted in the total, the coco-nut forms the most important export crop. It is the natural crop for the narrow coastal plains of the south and east, and the growing modern demand caused by the various uses, from butter substitute to cattle food, maintains a steady market. Very large plantations have been established, and the Philippines are the leading region of copra production in the world. Recently great strides have been made in improving methods of production. The same applies to the sugar cane industry.

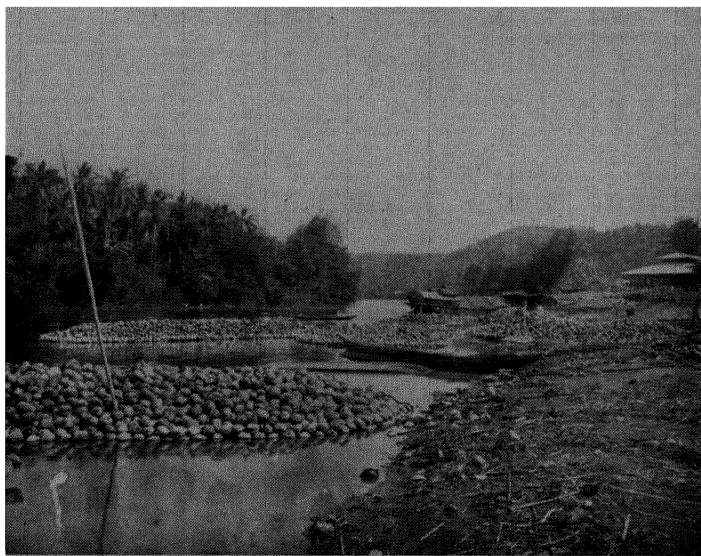


FIG. 120. COCO-NUT RAFTS, PHILIPPINES

The world's insatiable demand for vegetable oils is the explanation of this curious method of assembling and transporting the coco-nuts.

Formerly, the methods of refining were in sharp contrast to the more up-to-date methods employed in Hawaii and other parts of the world. In 1913 there was only one modern

central mill for refining, while elsewhere the crushing was done by means of long wooden rollers moved by cattle, and the 'refining' in some districts was carried on in iron kettles in the open air. There are now about fifty modern mills, and the progress of the industry is reflected in the growth of

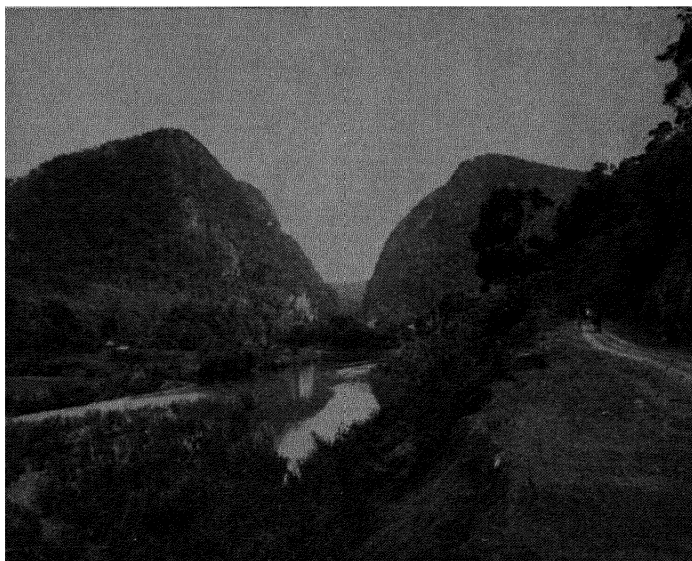


FIG. 121. A river valley near Manila, on the island of Luzon.

the export trade. The present production is over one million tons of sugar and about 50,000 gallons of molasses a year.

To the north of Luzon is a valley region where the silt deposits have built up a soil bed in a climate that is most suitable for the production of tobacco, which has become a main crop in many of the smaller islands also. The quality of the leaf has become famous all over the world, and is particularly used in the manufacture of cigars. Most tropical products are grown somewhere in the islands, but sugar,

abaca, copra (and coco-nut oil), and tobacco are those of which the Philippines have become most important in production.



FIG. 122. HUMAN CARRIER

Ilongot basket woman, Campote, Philippines. Transport in hilly jungle country is a problem in all the monsoon areas, and portering is a well-established occupation.

Economically the mountain region is relatively undeveloped as yet. The rich and extensive forests are the chief potential wealth; but, up to the present, very little has been done to develop them in a careful and scientific manner. In certain mountain districts of Luzon, however, remarkable work has

been done by the natives in terracing the mountain slopes. The stone walls holding the soil in place are estimated to be over 12,000 miles in length, and to have taken a thousand years to construct. By means of these terraces every drop of the rainfall is used, for even in the rainy season there is little run-off. To some extent the soil is held in place and is prevented from washing down the water-courses. In care of soil beds and in water conservation this supposedly primitive people has given a remarkable lesson to farmers in every country around the Pacific. They have arrested soil erosion, the scourge of modern agriculture.

Approximately half of the fifteen millions of people in the group live on the large northern island of Luzon. For this its size and fertility are responsible. The remaining inhabitants are scattered over Mindanao (pronounced Meen-da-nay-oh) and a few other of the larger islands. Racially, the people, or rather peoples, of the group present an extraordinary mixture. Although the majority are of the same origin and are termed broadly Filipinos, many groups would refuse to accept that classification. There are three distinct racial stocks in the group, viz., Malay, Mongolian and Negrito, but in the last few hundred years there has also been a large infusion of Spanish and Chinese blood. More than a score of different languages and dialects have been written, and many more are only spoken as yet. One authority distinguishes eighty-eight, and the main groups differ as widely as do French and German. Added to this confusion are the religious differences. Of the total population, nine millions, mainly in Luzon, profess Christianity, and these may be regarded in general as the Filipinos. Another half million, the Moros to the south, are adherents of Mohammedanism, while three-quarters of a million are

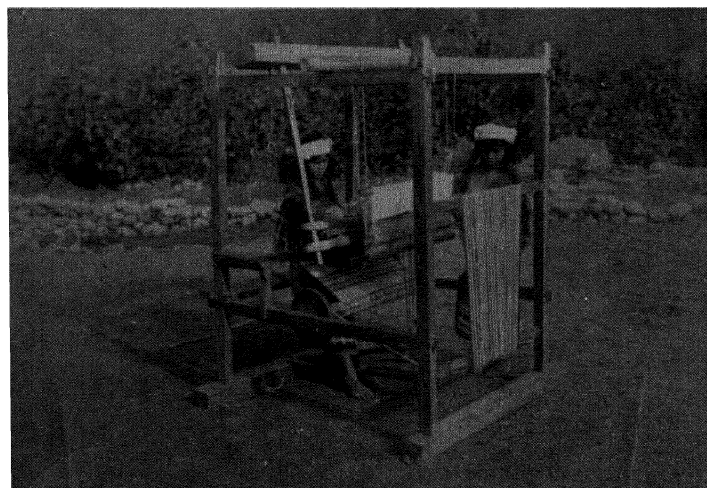
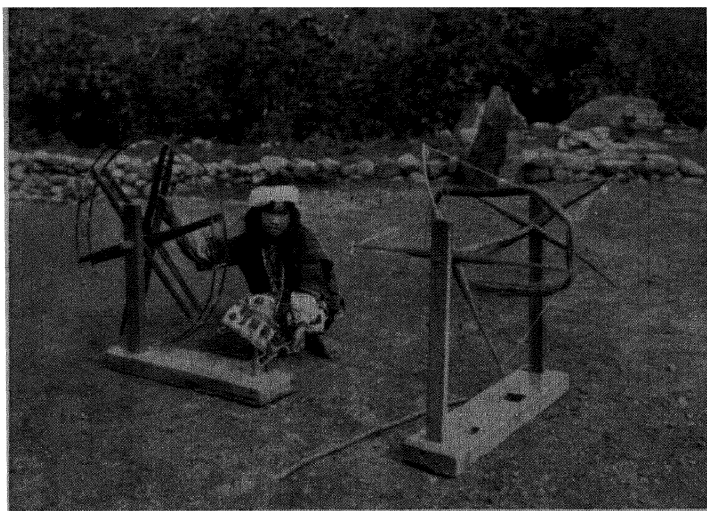


FIG. 123 (upper and lower). ANCIENT HANDICRAFTS IN
THE ORIENT

Native girls of Benguet, Philippines, reeling and weaving cotton.

made up 39 per cent., and sugar, molasses, and syrup 38 per cent.; sugar was by far the most important single item in the export trade; abaca made up another 14 per cent. The chief imports were cotton cloth and cotton goods, and various types of machinery.

CHAPTER XXIV

THAILAND AND INDO-CHINA

OF all the lands facing the Pacific that great peninsula between India and China termed Further India, or Indo-China, is perhaps the least known. And yet, especially from the aspect of human geography, very few lands have a greater interest. The position of the region at the south-east corner of Asia has made it a passage-way for many migrations and invasions of the past. Mongols from China, Dravidians from India, Malays from the south-east, pirates, explorers, soldiers, missionaries, and traders have entered and traversed the region from early time. Not once, but many times, the people in possession have been pushed aside by newcomers; and civilizations have arisen and decayed, leaving only a few relics overrun by the jungle. The people who at present inhabit the country are thus a compound of the many elements left by these invasions.

The country falls naturally into three broad strips or zones, determined mainly by the parallel north-south arrangement of the mountain system. Extending from the knotted mass of highland in South China, many ranges stretch south-

ward like the fingers of a hand between the chain that runs down the west side through the entire length of the Malay Peninsula and even beyond, and the broader chain of the

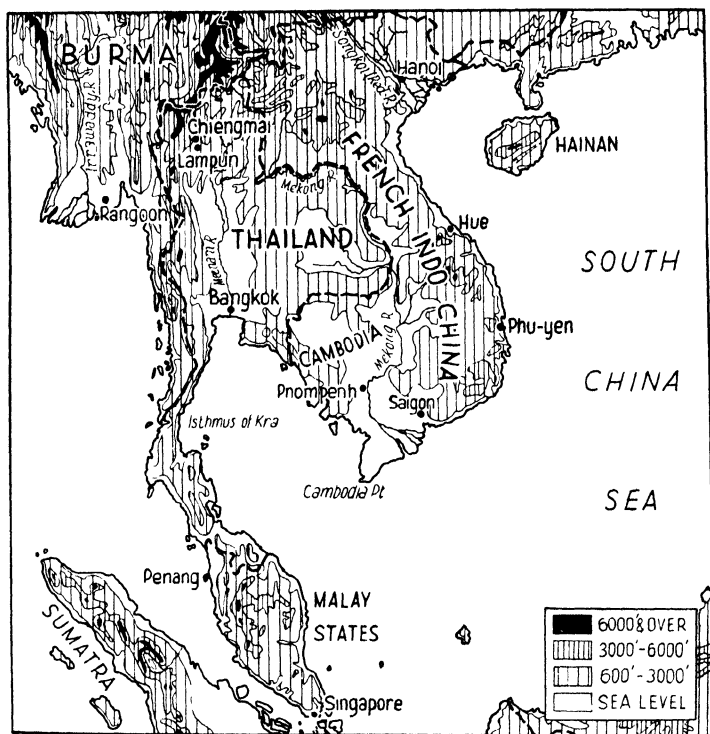


FIG. 126. Malaya, Siam and Indo-China.

mountains of Annam which curves round close to the east coast. In these ranges many peaks rise to heights of about 8,000 feet, and the arrangement of the highlands has a powerful bearing upon the whole life of the region. The

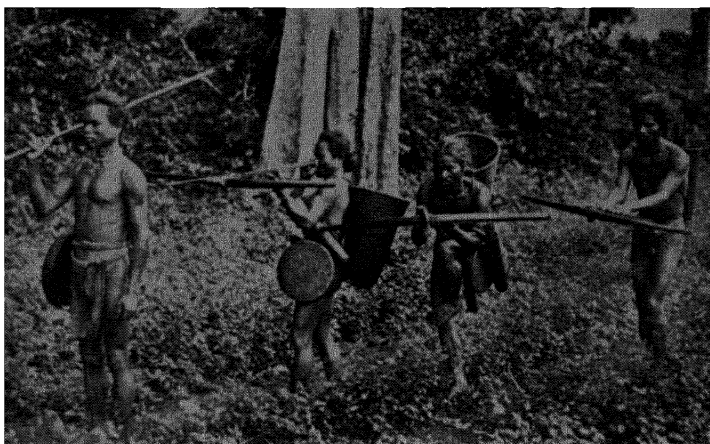


FIG. 127. PRIMITIVE PEOPLE, ANNAM

Compare this picture with that of the Australian aboriginal, Fig. 59. These people are hunters, living in wild jungle country.



FIG. 128. GROUP OF MOIS

These are native tribes living in the Indo-Chinese mountains. They are sturdy and gentle people, mainly living by agriculture, although they can work iron and weave cotton and silk.

shorter ranges fall away to great basins formed by the flood-plains of such rivers as the Menam and the Mekong, and of the innumerable smaller streams which feed them. The plains themselves gradually merge into the deltas lying around the mouths of the rivers, a swampy mangrove-fringed region to the north of the Gulf of Siam.

The foothills in the far north form a primitive jungle region inhabited mainly by wild hill-tribes who are the pioneers of the country, conducting a little rude cultivation around the small clearings they carve from the forest, and waging incessant war against the jungle and its denizens. Draining these hills are the countless streams running through rugged gorges, and emerging into broader and less forested areas where cultivation is more prominent. In the southern part of this flood-plain are the great areas of rich alluvial soil upon which the population of the country clusters. This part of the plain is a vast rice-farm between the mountains upon the east and west, and across it the rivers wind sluggishly before depositing their main burden of silt in the deltas. But not more than a fourth of the entire area is under cultivation, although the provision of irrigation and drainage schemes will undoubtedly support far more people here in the near future. Year after year the plains are flooded after the rains; and the great deposits of silt are slowly raising the level of the country, and pushing the coast-line into the Gulf of Siam at the rate of about a foot a year.

To the east under the lee of the Annam Mountains is an area of poorer soil and thinner forest interspersed with huge difficult swamps. In this inhospitable land live nearly two million people, 'wresting from the reluctant soil crops barely sufficient to maintain an existence which, passed amidst damp and mud for one half of the year and in a dry, hot and

dust-laden atmosphere for the other, is one of the most miserable imaginable, especially since the neighbourhood is peculiarly liable to epidemic diseases affecting both men and cattle.' (W. A. Graham).

In sharp contrast to this are the gentler conditions of the

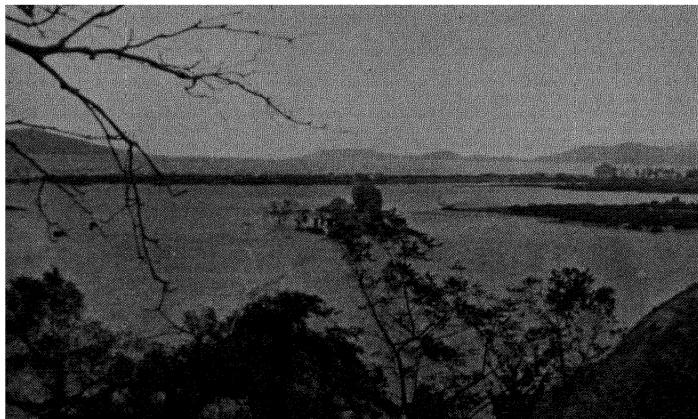


FIG. 129. ESTUARY NEAR HUE, ANNAM

The provinces of Indo-China, from north to south, include Tong-King, Annam, Cambodia and Cochin-China. This estuary bears a name meaning "River of Perfume" and is typical of most of the "China Coast."

south, where with fertile land, an equable climate, and little or no disease, the lot of the natives is far happier.

The three great rivers mark out roughly the three political divisions. Burma, with which we shall not deal, lies to the west of the Salwen and the main Kwaa Range. Thailand lies between this boundary and the River Mekong, with the exception of the lower basin of that river, which, with all the remaining country to the east, comprises French Indo-China or Annam and Cambodia.

The climate of the whole region is of the true monsoonal type; but the rotation of hot weather—rains—cool season is regular only in a broad sense. Over the alluvial plains in the hot months from March to October the south-west winds bring up the rains from the Gulf, but after October the wind blows from the north-east. Since the whole inland area is sheltered by the Annam Mountains, this season is dry. Over the greater part of the country the rainfall varies from 40 to 100 inches in the year, but most of this falls in from three to five months. This is sufficient over most of the country for all forms of tropical agriculture, but the main occupation is rice-growing. The whole life of the country turns upon the success or otherwise of the crops, and no other industry except fishing takes such a large share in the activities of the people.

‘Rice constitutes almost the sole food of everyone from the lowest to the highest; horses, cattle, dogs, cats and all other domestic animals live on it; it is used for making beer and spirits; it enters largely into all ceremonial, while religious and superstitious observances in connection with its cultivation provide the people with their most frequent occasions for holidays and festivals. The most generally recognized means of investing money is buying, or lending on, rice-fields; the nobles are graded according to the grant of rice-land that goes with their patent of nobility; dealings in rice and the ownership of rice-fields are the cause of most of the civil litigation in the law-courts; and the result of the last or the prospects of the next crop provide the most absorbing topics of conversation and discussion at all times. It is rice that forms the cargoes of thousands of boats ever passing up and down the rivers; it is rice that feeds the mills of the metropolis and the husks feed the furnaces; it is rice that is carried away in the ocean-going steamers always to be seen loading in the ports; it is rice from which the Government derives almost the whole of its revenue.’ (Graham.)

This quotation from a writer on Thailand could refer to almost any country or island of southern or eastern Asia.

Since the methods of rice cultivation are so similar throughout the Orient a brief description of the most usual processes involved will not be amiss. On the lowlands, or even upon the terraced hill-sides, fields in the shape of flat

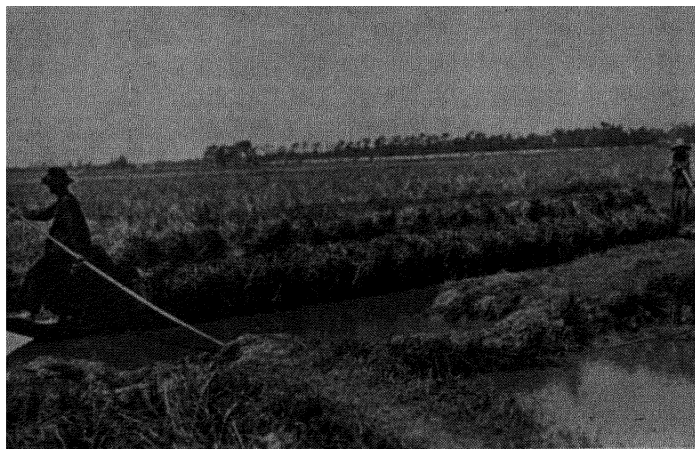


FIG. 130. RICE BARGE, THAILAND

The alluvial plains of the River Menam and its tributaries are the real Siam. These silt-soils are the great rice-fields which provide a large surplus for export.

pans are formed by raising all round a low wall about a foot high. Baked hard in the dry season, these fields rapidly absorb the water when the rains come; and the farmer then sets to work to raise his seedlings in the prepared mud of a corner of one of the fields. When the fields are wet enough they are ploughed, weeded, flooded, and worked up to a consistency of porridge. Then the padi-field is planted by men and women standing knee-deep in mud and water

The young plants are put into the mud in bunches of four or five, and then left until the ripening period approaches, when the chief anxiety is the attacks of birds. As at planting, so at reaping, every one turns out, and with knives and sickles the crop is gathered into sheaves on a prepared patch of ground where it is threshed by cattle treading out the grain. It is then winnowed, and sold on the spot or stored as the farmer decides.

Other important crops in this region are the coco-nut (especially on the lowlands near the coast), rubber which is still in its infancy, pepper, tobacco, sugar, cotton and sesamum, a plant alternated with rice and grown for the sake of the oil contained in the seed. Many other plants,



FIG. 131. SHANS, NORTH THAILAND

The Shans are Thai highlanders, and are less Mongolian in feature than the Chinese. They are skilled in arts and crafts and are more like Europeans in complexion than any other Asiatic race.

such as beans, betel-nut, cardamom, maize and hemp, are cultivated to some extent all over the country.

As only one-fourth of the surface is cultivated, the great

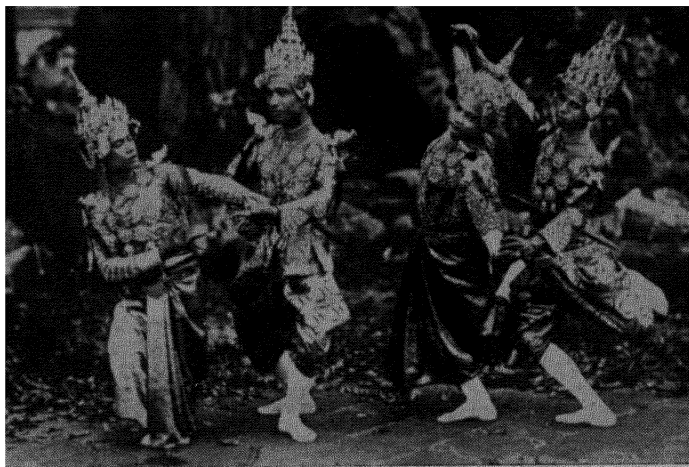


FIG. 132. MALE BALLET, THAILAND

The ornate costume, striking head-dress, and stately poses subtly express the tradition of the dance.

forests, especially in the hilly interior, represent a comparatively untouched asset. Timber-getting with the aid of elephants is an important industry in parts, and teak forms the principal item in this industry, although many other timbers are also becoming known and valued.

Fish is the second great staple of diet right through the Orient, and in some form it figures on every menu. Sea-fishing is important all round the coast, especially north of the Gulf, and very curious to Western eyes are the methods used to obtain the catch. In addition the canals and lakes of the lowlands teem with fish, so that the inland areas also

have the benefit of 'the double larder' of the land and the water.

Owing to the great extent of a country that is either alluvial plain or jungle very little mining is possible. The mountain regions, however, especially the two main ranges, are rich in minerals. The great granite range that runs down to Singapore is the source of two-thirds of the world's tin, mined mainly in Malaya; but the Thai section has been producing some 16,000 tons per annum in recent years. Copper is also mined in Siam, while the Tonking area produces coal, zinc, and tin.

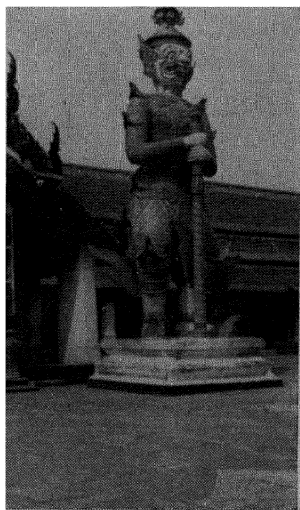


FIG. 133. TEMPLE GUARDIANS AT BANGKOK

A fearsome warrior and a bird-man ward off evil spirits which might disturb religious exercises.

The chief centres of the region may now be briefly noticed. *Bangkok*, 20 miles up the Menam estuary, is a city of 680,000 people, built along the canals and river channels

and is the seat of government. *Chieng Mai* (30,000) in northern Thailand is the second town, while the ancient capital *Ayuthia*, chiefly built on piles, is still a place of

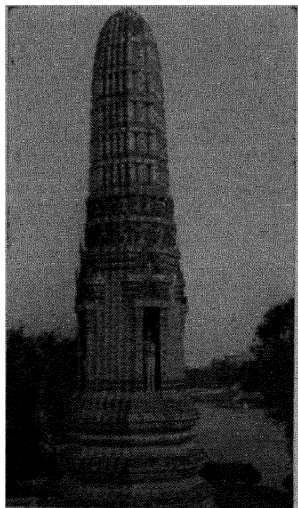


FIG. 134. WAT CHENG
AT BANGKOK

These pagodas, sometimes temples, sometimes extensive religious centres, are common throughout South-east Asia.

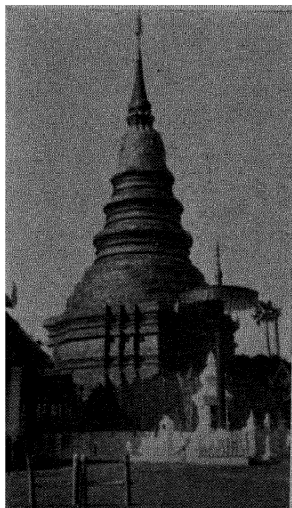


FIG. 135. PAGODA AT
LAMPHUN

Buddhism is the prevailing religion in Siam and there are over 16,000 temples. The word "pagoda" is probably a corruption of the Persian *but* (idol) and *Kadah* (house).

importance. *Puket*, on an island off the west coast, has tin mines that are reputed to be 2,000 years old. The main railway line runs from *Sungai Golok* on the border of British Malaya north to *Chieng Mai* and is practically the only system in the country. Further lines are planned mainly in the productive midlands. The port of *Saigon*



FIG. 136. TRADING BOATS, ANNAM

In South-east Asia the rivers are the main highways and a large population of boatmen and their families spend their lives on the rivers.

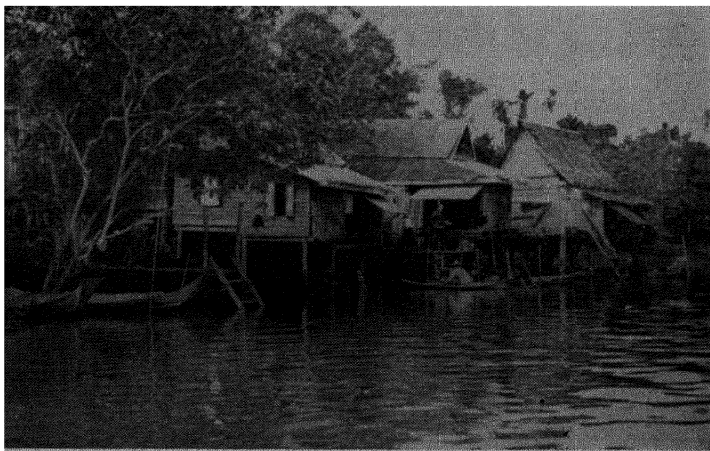


FIG. 137. THE KLONGS, BANGKOK

Since the rivers are the main trade routes, warehouses built on piles, called *Klongs*, are established along their banks.

is the outlet for the lower basin of the Mekong, although like most delta ports it is not actually situated on the main stream, and *Pnom Penh* is the chief town of Cambodia; both are important trading stations for the French territory in the east. Another lowland area occurs at the head of the Gulf of Tonking, of which *Haiphong* is the chief port, and *Hanoi* the commercial capital and the centre for French rule in Indo-China. As in Malaya and right through the islands, the commerce and much of the plantation country are in the hands of Chinese.

The people of Siam have always been known as 'Thai' or 'The Free People,' and they prefer to call their country 'Muang Thai,' 'the country of the Free People,' rather than Siam.

CHAPTER XXV

CHINA

1. *The Great Problem of Agricultural China in an Industrial World*

CHINA is the great riddle of the Pacific, and perhaps the greatest problem of the modern world. China is immensely old, judged by the raw youth of the 'Great Powers'; intensely conservative measured by the vast changes that have swept the Occident since 1800; and still, for the great masses of the people, inward-looking and dominated by inherited custom and persistent insecurity. Always concerned with the 'battle for bread,' the Chinese suffer patiently under aggression and war; and the other nations almost despair of fitting the Chinese into the modern industrial economy. Four hundred and fifty millions of

people, mostly settled into an ancient small-farm system, with pitifully small family incomes, in a political system which is evolving painfully from feudalism to democracy, can be adapted only with tremendous difficulty to a modern world system of which the strength is industrial power. To take a full share in such a world system, China must develop manufactures; and the change can only take place with exasperating slowness unless China can be helped to acquire the great instruments of modern life—railways, roads, ports, factories and all the appliances of production and trade.

All this will mean the transfer of capital to China on a scale unsurpassed in the history of the world, because China's ability to hold her place as a great power and her ability to shape a unified political system will depend mainly upon success in raising the purchasing power and the economic security of her teeming millions. The other nations are slowly coming to the conclusion that there can be no sustained peace in the Pacific until this vast bewildering problem of China's future is understood; and unless the nations agree to co-operate in the greatest programme of assistance the world has ever seen. Here are problems which will keep the engineers, the statesmen, the economists, the financiers and the diplomats busy for a century; and it is urgently necessary that not only the peoples of the Pacific but all nations shall understand the geographic, racial and economic conditions which underlie this great problem, and is the background of chronic civil war.

The task is twofold—to help the Chinese to develop as quickly as possible their own resources, on the one hand, and to find some means by which the resources of other countries can be brought to their assistance. This is little less than a great application of the principle of lend-lease,

of the use of world resources for the great aim of world peace and common welfare. Little more can be done in these few pages than to sketch the basis of Chinese life and work, and to describe in the most inadequate way the physical framework in which that life and work must go on.

2. The Build of the Country

The contrast between an island homeland and the conditions of life in a continent is most forcibly presented by the great land-mass of China. That the contrast is a very vivid one in many ways will become clear as that great eastern division of Asia is studied. The chief difference which will be noticed is in regard to human life. While he gains much in culture and industry by having to live closer to other races, man loses in such a continental homeland much of the freedom that island life confers; and he is more open to influences, for good or ill, from neighbouring peoples. This has already been noticed in the case of Siam, but the effects are much plainer and more stubborn in the case of China.

The massiveness of the Chinese homeland makes the greatest impression on the mind. China proper is a compact unit; and with the provinces of Mongolia, Turkestan, Tibet and Manchuria it has an area of half as large again as that of Australia, and greater than that of the United States and Alaska together. Although one-third the size of the British Empire, it contains more people. It lies, like a half-opened fan, between great mountain ribs nearly 2,000 miles in length, stretching from the Pamir Plateau to Manchuria in one direction, and to the Gulf of Tonking in the other.

Most of the surface is very mountainous, and only along the lower valleys of the great rivers is there any considerable area of low-lying plain. A glance at any physical map of China will show how very broken is the surface away from

the river valleys. The great barriers of the Kuen Lun and allied chains on the north, and the Himalayas and Yunnan Mountains to the south make passage in or out almost impossible, except by air or along the very difficult river gorges; and this has served both to isolate and to defend the Chinese people.

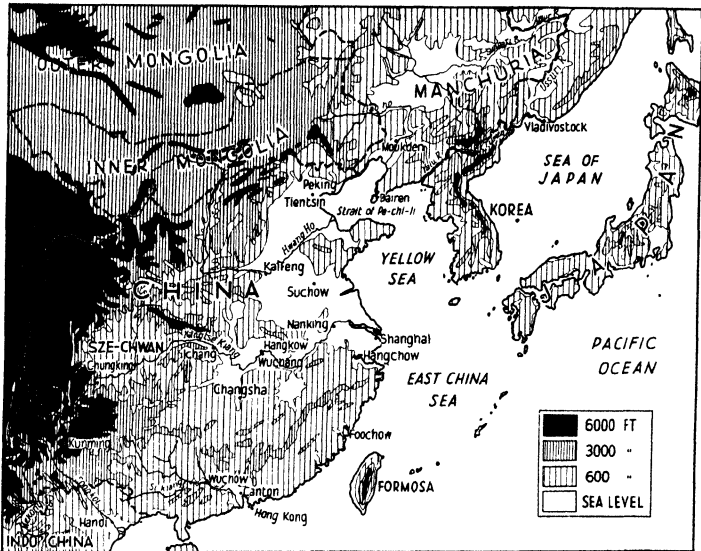


FIG. 138. The Build of China.

Viewing the land broadly, the major divisions into which it falls should be noted, but within each is a very great variety of surface which cannot be discussed in detail. These divisions are (i) the two wide plains in the north-east, which are perhaps the most important area in China if production and trade only are considered; (ii) the tumbled mass of mountain and plateau to the centre and west; (iii) the

comparatively small and isolated, but very important, peninsula of Shantung, and (iv) Manchuria. The most northerly of these two plains is a stretch of about 300 miles in width sloping gently to the Pacific between the latitude of Peiping on the north and Hangchow on the south. The second plain area is that comprised by the lower valleys of the Yang-tse river and its tributary, the Han. The rest of the country is a rugged highland, bisected by the Yang-tse, and rising by high steps to the topmost plateau of Tibet. The northern and southern lands of this great highland region differ very largely in their power to support plant and animal life. In northern China cultivation is possible up to 8,000 feet above the sea, owing to the peculiar soil conditions discussed later; whereas in the south the steep slopes and poorer soils confine agriculture to levels below 2,000 feet.

One other region must be noticed in this broad sketch, that of the fertile middle area of the Yang-tse known as the Szechwan or Red Basin. Here limestones and red sandstones have given rise to a fertile soil which has been carefully terraced and, with the aid of irrigation, turned into a highly productive region. Apart from the river valleys and plains, and the Red Basin, China is a 'wild and intricate region, scantily populated.'

3. *Climate*

The climate of China is governed by the monsoonal indraught to the continental 'Low Pressure Area' in summer and by the outflow from the continental 'High' in winter. Thus the winds in summer are from the south and east, while in winter they come from northerly directions. However, the very definite effects in the coastal areas fade away inland and to the north. The enormous extent and the varied surface of the country produce many kinds of climate

from the hot summers and bitter winters of Manchuria to the monotonous heat and humidity of Yunnan. The Yang-tse valley experiences extremes of temperature; the winter temperatures are particularly low because of the cold winds which sweep out from the interior; the January temperature at Hankow, for instance, is 37° F. Actually some of the basins further inland are sheltered from these cold winter winds and experience higher temperatures than the coastal areas. The variations in temperature, rainfall and wind direction for typical localities in the more populous areas are well worth close study, and the main facts are given in the following table:

CLIMATIC DATA FOR SHANGHAI AND ICHANG

<i>Month</i>	<i>Shanghai</i>			<i>Ichang</i>	
	<i>Temp F°</i>	<i>Wind Direction</i>	<i>Rain Inches</i>	<i>Temp. F°</i>	<i>Rain Inches</i>
January	37	NW	2·15	39	0·38
February	39	NW	2·29	41	1·23
March	46	NE	3·2	55	4·13
April	56	SE	3·6	62	3·21
May	64	SE	3·6	74	3·6
June	75	SE	6·7	76	5·48
July	80	SE	5·1	78	8·14
August	80	SE	5·9	82	6·03
September	72	NE	4·7	74	5·65
October	63	NE	3·3	64	0·57
November	52	NW	1·9	55	0·84
December	42	NW	1·2	45	0·62
	Total 43·6			Total 39·8	

A striking weather feature in the coastal areas is the occurrence about a dozen times a year of typhoons, storms of the hurricane type that are characteristic of sub-tropical

east coasts. These winds develop somewhere in the neighbourhood of the Carolines and move westward, causing great havoc, especially to shipping.

4. *Vegetable and Animal Life*

The vegetation of China must at one time have been extraordinary in its variety and luxuriance. Even now, after centuries of devastation by man, almost every temperate and sub-tropical tree, including both hard and soft woods, every fruit and every cereal is known and grown. Dense settlement has interfered greatly with the natural vegetation, and deforestation, in particular, is one of the great tragedies of China. Apart from the cultivated plants little natural vegetation now remains over very wide areas; and rich districts have been reduced to deserts. Even the grasses are pulled, roots and all, to serve as fuel in many districts; and the soil thus unprotected is swept as useless rubble down the watercourses. The bamboo is the typical plant of the monsoon regions, and means much to the inhabitants of south-east Asia.

'With it they build houses and erect temporary shelters; it is used for all scaffolding purposes and for the transport of all goods by human agency, from the smallest market produce to the grand piano in a foreign settlement; when full grown it supplies the vast water population with masts, and from it are made chopsticks, pipes, umbrellas, tables, stools, and musical instruments. When young it is used as food.'

Between forty and sixty varieties are known, and its uses must number thousands.

But the great wealth of plant species cannot be realized. Beautiful and useful trees such as the camphor, ebony, teak, plane and mahogany; flowering plants which we have appropriated for our gardens such as camellias, azaleas, asters,

and chrysanthemums; and a whole range of food plants from tea to millet comprise some of the varied resources of this marvellous country.

Despite this wealth, and the fact that 80 per cent. of China's people are engaged in agriculture, food-stuffs are not produced in sufficient quantity to supply home needs.

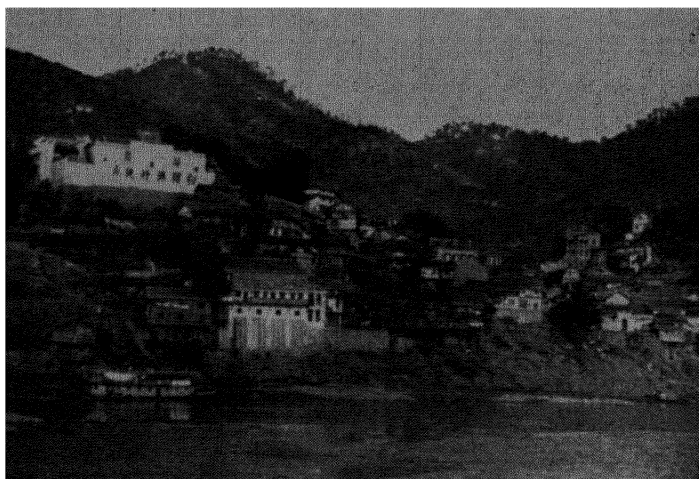


FIG. 139. A View of Chungking.

The great pressure of population has developed methods of agriculture that amaze the world. The careful, intensive cultivation of the Chinese has for centuries included many devices for producing the most from the soil that have only been employed in Europe in the last century-and-a-half. But more than half of the holdings average less than $1\frac{1}{2}$ acres, and much even of this is useless because of the desire to maintain untouched the innumerable graves of ancestors.

The destruction of the plant life has also meant the disappearance in large measure of the wonderfully varied

animal life. No other continent was originally so rich in animals and birds as Asia, and China was a favoured region of the continent. Even now the numbers of animals in the mountain regions must be very great, and no other country supports more animal life of the domestic type, from the pig to the camel, than China. But land that can be cultivated is too precious to be used for grazing, especially in southern China. Fish are more than usually important in the scheme of things. The diet of the millions in the plains and along the coast consists largely of rice and fish. The great wealth of fish life in the rivers and lakes is carefully supplemented by the rearing of fish in pools all over the country. The continental shelf of China is also particularly rich in fish life, and the fishing industry is relatively as important here as it is on the Grand Banks of Newfoundland, or round the Dogger Bank in the North Sea.

5. *The Rivers*

The real China, however, the China of the vast crowded masses, is the land of the great river valleys. The Hoang-ho in the north, the Yang-tse in the centre, and the Si-kiang in the south are the three threads on which hangs the life of the Chinese people.

North China is for practical purposes the valley of the Hoang-ho. If we take as a dividing line the watershed between this river and the Yang-tse, the provinces to the north are distinct in every particular—climate, crops, character and customs of people—from those of the south. Our line in fact marks the boundary of the true monsoon region, and the northern limit of the rice and the bamboo. To the north these are largely replaced by wheat, millet, and forests, and both people and scenery are influenced by the change. Even the domestic animals are different, the ox and the

camel taking up the role played by the buffalo farther south Nature gives more grudgingly, life demands more effort, and this niggardliness of the homeland is reflected in the sturdier minds and bodies of the northern people.

The second factor in the human geography of north China is represented by *loess*. This is the name of the dust blown for centuries from the highlands of Asia down the valley of the Hoang-ho. When the wind blows from the north the air is filled with a yellow fog so dense that even shipping off the coast is interrupted. Loess has piled up thousands of feet deep, covering like a yellow air-alluvium all but the higher parts, and forming a loamy soil of wonderful fertility. Into this friable deposit the streams have cut deeply, and the burden of yellow silt gives its name to the great Yellow River (Hoang-ho) and later to the Yellow Sea where it used to discharge. Roads, too, have been worn down through the soil in canyons 30 to 50 feet deep. 'Along these roads and out of their vertical walls the inhabitants have excavated their dwellings—originally simple caves in the loess, now developed into houses of two and three storeys with wooden doors, window-frames, and staircases, houses warm in winter and cool in summer, and marvellously free from damp.' The lower levels of the loess plain of northern China may be a vast inland sea in flood-time, endless miles of growing crop in the summer, or a monotony of bare brown soil in the winter.

Middle China is merely Kiang, '*The River*,' as the Yang-tse is called by the millions who dwell on its fertile banks or on its broad surface. The masses of people are crowded into its valley, because the river valley is the great granary as well as the main line of trade and communication right into the heart of Asia. The merchandise passing through Shanghai alone represented over 40 per cent. of the total foreign trade

of the country. Added to this is the importance given by its consistent climate and regular crops. The typical products of the region, rice, silk, tea, and cotton, are the staples of commerce. In spite of poor coal supplies these products are the basis of great industries, and the spinning of silk and cotton, the preparation of tea, the making of porcelain and steel, and the production of oil afford occupation for millions. The area of the basin is about 600,000 square miles and supports 200 millions of people. For pressure of population this is rivalled only by the Ganges Valley. The gateways to the provinces of the basin are the great ports of the country such as *Shanghai, Chinkiang, Wuhu, Hankow, Changsha, Nanking, and Ichang.*

In the mountain region the stream is of little use for transport since it falls at one place nearly 7,000 feet in 150 miles. In contrast to this it drops only 500 feet in the last 1,000 miles of its course, and this portion is the main highway of the country. The melting of the snows in Tibet causes great floods, when the river sometimes rises 100 feet in its middle course. The average volume of water is tremendous, and by its aid the mountains of Asia are being slowly but steadily moved a thousand miles east, and spread over the plains as silt, or dropped into the Pacific. The amount of silt carried out to sea each year is said to be sufficient to build a new island one mile square and 100 feet deep, and that after an equal amount has been spread over the rice-fields of the basin. The Si-kiang, although small compared to the Yang-tse, is a river comparable in size to the Murray, and navigable for nearly a thousand miles.

In the coastal plain area the Chinese have constructed a great system of canals. There are about 200,000 miles of canals in the whole of China, the bulk of which are in the Yang-tse plain, and in the Si-kiang basin. These waterways

provide slow but cheap transport. In the 390,000 square miles of the Si-kiang basin live 60 millions of people. This represents a density of about 150 people per square mile compared with 160 on the Hoang-ho and 420 on the Yang-tse basins. Although the region has a sub-tropical climate, the soils are poor, and the pressure of population has forced the people to emigrate. The Cantonese have been called the 'Anglo-Saxons of China' and in search of trade or employment they have penetrated to every corner of the Pacific, from Tasmania to British Columbia.

The outer provinces of Mongolia and Tibet are great plateau regions which are, at the moment, of little economic importance. The difficulties of transport, the harsh climate, the nomadic character of the people, especially in Mongolia, and the small range of production are the chief features to note. Nevertheless it is probable that Mongolia, in particular, is very much under-developed, and both China and the U.S.S.R. will be interested in its future. If those provinces are taken into account, China must be regarded as being self-contained in a very high degree, especially if the great mineral wealth of the mountain areas is taken into account.

The Shan-tung Peninsula, largely because of its position with relation to Japan and Manchuria, is an exceedingly important area. Comprising 56,000 square miles of country, mainly mountainous, it is the home of 31,000,000 people; and in respect to cultivation, railways, communications, industries, and mines it forms one of the most highly developed regions of China. It has very important coal-mines which provide power for the various industries; the silk industry has reached its fullest development in the valleys and along the lower slopes of this area.

A significant aspect of China's development in the last decade has been the progress of industrialization. Shanghai

remained the chief industrial centre, but there was an increasing decentralization of factory production. The cotton industry was still the most important, but the heavy indus-



FIG. 140. CHINESE LETTER-WRITER

So few people are educated and so difficult are the characters or ideographs that professional letter-writers are universal throughout the Orient.

tries and sundry smaller industries, such as the manufacture of electrical appliances and paper, made great progress. Since Chinese secondary industry was concentrated along the coast, in the region of Japanese attack, many of the factories were dismantled and transferred to provinces further inland. After real peace returns, a more widely distributed and greatly expanded secondary production can be expected.

The importance of Chinese cities is here mainly measured by their trade, but with regard to population and historic

importance this is often an unfortunate test. The chief routes are, of course, determined by the relief of the country, and position near the gateways or along the main route to one of them is of the highest importance for trade. *Peiping* (1,550,000), the ancient capital of the lowland coast route between Manchuria and the south, is the largest overland trading centre, and was the capital until recently; and *Tientsin*, the chief port of the region, represents the northern gateway. *Tsing-tao* with its port of *Kiau-chau* are the main outlets for Shan-tung. *Shanghai* (3,500,000), 'the New York of the Orient,' is the collecting and distributing point for central China, and the sea-gate for the very productive

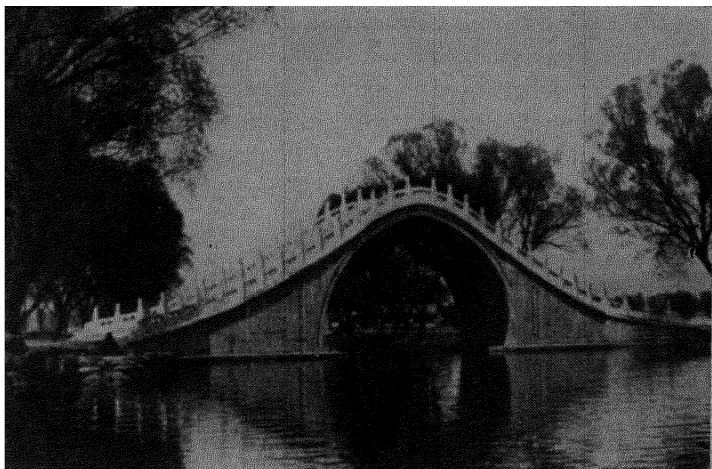


FIG. 141. MOON BRIDGE, PEIPING

This marble gem is in the grounds of the Summer Palace.

Yang-tse valley. Originally a concession of swamp on the banks of the Whangpoo, an arm of the Yang-tse, it has been made one of the greatest ports of the Pacific mainly by the

energy of British merchants. The river ports *Hankow* (780,000), the trade capital and largest town; *Nanking* (1,000,000), which became the centre of government in 1928; *Chinkiang* (200,000); and *Ichang* (108,000) are all important trading centres with tea and silk as staples. *Foochow* (325,000), *Amoy*, and *Swatow* are coast ports. *Canton* (861,000), most progressive and most restless city in China, is the southern gateway. *Hong Kong* (641,000), a British possession, is on a small island eleven miles long and about three wide which was originally a bare rock rising to about 2,000 feet above sea-level. The splendid harbour has been made the finest port of China and the chief gateway for foreign trade. It is also an important distributing centre for the Pacific islands of the west Pacific.

At the present moment industry and production of all kinds is halted and dislocated by political reconstruction. It is not possible to predict how long social and economic reorganization will take in this, the greatest of the Asian nations; and, consequently, it is not possible to present even a summary picture of production and trade. Assuming persistence of rural activities and regional industries in the midst of prevailing unrest of all kinds, there can be little doubt that the Chinese, under the influence of modern pressures, must effect a gradual but effective conversion of resources, and a better distribution of national output.

CHAPTER XXVI

MANCHURIA, MONGOLIA, TIBET, SIBERIA

1. *Manchuria*

PHYSICALLY this region may be described as an extensive uneven plain sloping generally towards the Yellow Sea or its northern gulfs, and enclosed by high mountain ranges on the east and west. It is a region of great importance because of its position on the frontiers of China, Russia, and Japan. This political situation has served to retard rather than to advance development, although since the construction of railways across the region progress has been more rapid. The soils, in general, are good and the climate, although decidedly seasonal and continental, is not more rigorous than that of the Canadian Prairie. The winters are long and bitterly cold, with minimum temperatures far below freezing. The day and night average for January at *Harbin* is 0° F., and at *Mukden* 11° F. The summers are short and hot, the day and night average for July at Harbin being 72° F., and at Mukden 75° F., while temperatures of 95° F. are frequently experienced. During winter, the snowfall is light and the spring is usually characterized by drought, most of the rain occurring during the summer months. Fortunately, although the rainfall is limited, it occurs at the right season for growth, and crop failures through drought are uncommon except in the drier west. The other great handicap to agriculture is frost, the northern portion of the Manchurian plain having no more than 125 frost-free days in the year, which makes the growing season very short.

The chief crops are kaoliang, soya beans, millet and, in the north, wheat. Kaoliang is the staple food of the people

and soya beans are the great cash crop. The soya bean is valuable both as a food, because of its high protein content, and for its oil which is used in making a great variety of

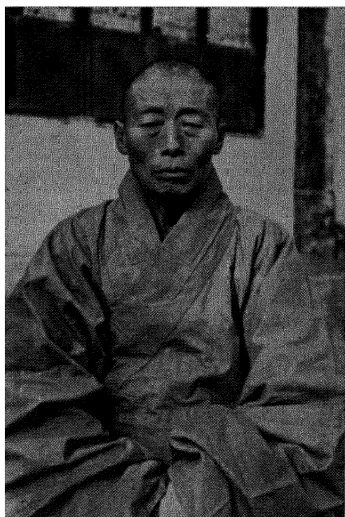


FIG. 142. Chinese Buddhist.

products ranging from paints and explosives to soap and butter substitutes.¹ Formerly large amounts were exported to Europe and the United States; but, after the establishment of Japanese rule, exports were increasingly concentrated on Japan. Japan, as part of her expectations from the conquest of Manchuria, hoped to gain food supplies; but these pre-war hopes were not fulfilled, and of recent years the shipments of foodstuffs from Japan to Manchuria have increased. It was also thought that emigration from Japan to the new

1. The uses of the soya bean are as innumerable as those of the bamboo. It finds its chief use as human or animal food, but it is also becoming the basis of extensive manufactures. Sauce (soy), table vegetable, flour; oil for a hundred purposes from cooking, lighting, and lubricating to the water-proofing of cloth, butter-, coffee-, and milk-substitute, soap and cosmetics, all these do not exhaust the list of articles to which it contributes the chief ingredient.

colony would lessen the population pressure at home, but surprisingly few Japanese farmers took up land in spite of government assistance. The Chinese from the famine areas in North China and Koreans who flocked there were prepared to work for a lower return than the Japanese would accept. Manchuria is now under the control of U.S.S.R.

The Japanese rapidly and efficiently developed the mineral resources of the region and established centres of heavy industry. *Mukden* (772,000), an important railway and industrial centre, is the largest city. *Harbin* (467,000), at the junction of the South Manchurian and Trans-Siberian railways, is the market for the great agricultural area.



FIG. 143. Part of the Great Wall of China.

Dairen (formerly *Dalny*), the port for southern Manchuria, has a good harbour and is ice-free all the year.

Note.—In view of the uncertainty about the political future of China, the overthrow of the Nationalist government by the Communist forces, and the delicate relations with non-Asian governments, comments upon current developments have been kept to a minimum.

2. Mongolia

This is a mountainous region best described as a high-level plateau of no great fertility. A large part of the surface, which covers more than a million square miles, is taken up by the cold desert of Gobi, which constitutes an



FIG. 144. Caravan on the way to Mongolia from Peiping.

effective barrier between China and Russia. The northern frontier runs through a very rugged and desolate region. Because of rainfall deficiency the area is a vast natural pasture-land, and the human and animal life is a direct response to these conditions. The natives are nomads, living in tents and moving north and south with the seasons. The harsh continental climate of these uplands demands great hardiness from the people and at the same time prevents any agricultural development. About two and a half million

people are estimated to inhabit this territory, of whom over two million are in Inner Mongolia.

It is a very interesting region for another reason. It is believed that this is the area which was the original home of the Mongolian race, and that fertile districts were transformed to deserts by climatic changes, their cities overwhelmed by moving sand, and their peoples driven to emigrate. The invasions of early times, and the Mongolian migrations of the south and across to America, are attributed by some writers to these changes of climate in prehistoric times.

In 1937 the Japanese set up a new autonomous government over part of Inner Mongolia, with its seat at *Kalgan*. The area is now under Soviet control. Outer Mongolia is ruled by the Mongolian People's Revolutionary Government, modelled on the Soviet pattern, which was established after the Mongolian Revolution of 1924. *Urga* is the chief centre.

3. *Tibet*

This is the largest, highest and most inaccessible plateau in the world; and it is isolated on every side by great mountain rims that make transport almost an impossibility. The least difficult approach is from the Chinese side along the river gorges, and it was in this manner that Tibet became a Chinese province by conquest in very ancient times. The surface of the region is extremely broken, the climate is one of great severity, and agriculture is almost impossible except in small areas of the sheltered valleys. As a consequence of climate and isolation the people are exceedingly backward, and very hostile to change. The chief feature of the life of the country is the hold obtained over the people by the large numbers of Buddhist monks who throng the monasteries of the plateau. The chief of the religious body is also the

political head and is known as the Dalai (or Grand) Llama. His seat is the walled fortress of *Lhasa*, important as a junction of caravan routes.

4. *Siberia*

The immense area known as Siberia drains mainly towards the Arctic, but because of the impossibility of transport moving towards the ice-bound ocean Siberia turns largely to the Pacific in the economic sense. This movement has been more obvious since the construction of the trans-continental railway which traverses the whole width of Siberia from east to west. The difficulties of climatic extremes, the difficult nature of the country, hindered development in the past, and little information is available about progress under Soviet Government. Siberia constitutes, however, one of the great unsettled pioneer belts of the world, an area of high fertility, large tracts of which are suitable for occupation and intensive development. Under the Soviet, settlement schemes have been carried out in western and central Siberia. The cold regions of the north-east are gradually being assessed, and already some effort has been made to develop the resources, and to export minerals, timber and furs.

Allowing for the plateau character of much of the mountain country along the east coast, the country falls into broad divisions largely upon the basis of climate. The whole of the region to the southern mountainous edge is exposed to the cold Polar circulation; and, lying as it does across the longest side of the world's greatest land-mass, its climate shows great extremes. The highest summer temperatures and the lowest winter temperatures are recorded for the north-east. *Verkhoyansk* in the Lena Valley is reputed to be the coldest place in the world, and a temperature of -90° F.



FIG. 145. Irrigation by treadmill is typical in Asiatic countries.

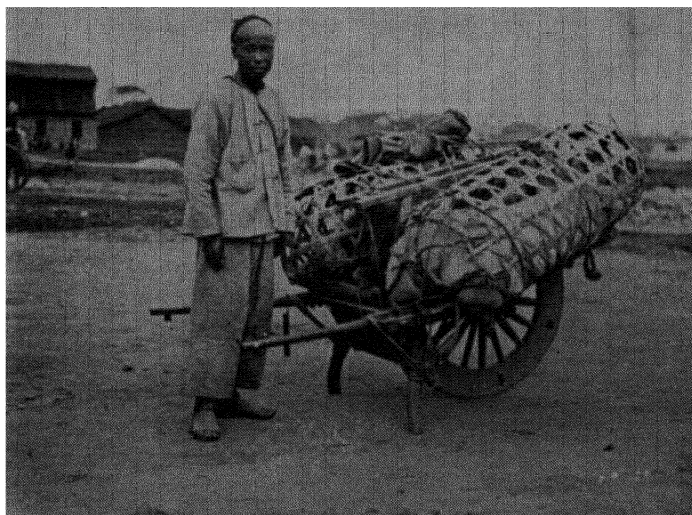


FIG. 146. Typical transport in China and provinces. Pigs on the way to market.

has been recorded. Rainfall is mainly in summer. The winter snow lies on the ground until the returning warmth of summer thaws the land. The chief control of vegetation is the intense cold of the long winter. The regions to be distinguished are: (i) The *tundra* or northern plains converted by the warmth of summer from an iron-hard frost-bound waste to a swamp region with flooded streams. (ii) The *taiga* or pine forest belt. This stretches across the country to the south of the tundra into which it gradually merges. It is very lowlying also and in parts almost swamp. The inhabitants are not at all numerous, and lead a very primitive life as dwellers on the forest edge. (iii) The *prairie*, great open plains to the south of the forest where the soil is excellent and the climate quite suitable for agriculture. It resembles very closely the similar region of Canada. (iv) The *steppe* country, which lies in general still farther south, and constitutes a great natural pasture. (v) The better valley regions of the south, where the conditions favour dairy-farming as the main industry. (vi) The very mountainous south, which has great undeveloped mineral resources.

The chief route of the region is the trans-Siberian railway which terminates at *Vladivostok*, the Pacific gate of eastern Siberia. Unfortunately the harbour, while suitable in all other respects, is blocked by ice for some months during the winter. The trans-continental line brings to this port the wheat, butter, and animal products of the southern area of Siberia. It actually enters the Pacific Basin after it crosses the Yablonoi Mountains at a height of 3,000 feet above the sea.

CHAPTER XXVII

JAPAN

1. *Structure and Relief*

THE Japanese Islands extend in two great arcs or loops from Formosa to Sakhalin, and number over a thousand. The six large islands are Sakhalin, of which only the part south of 50° belongs to Japan, Hokkaido, Honshu, Kyushu, Shikoku, and the Kurile islands. Of the total area of 148,000 square miles, Honshu alone comprises 87,000 or 60 per cent., Hokkaido about 25 per cent. Japan proper is a line of folding thrust up along the margin of the Asiatic block. This fold is a line of weakness in the crust, and for this reason the whole area is highly volcanic. Ranges rise to 8,000 feet with isolated peaks of which Mt. Fujiyama (about 12,000 feet) is the highest. As Japan is merely the unsubmerged top of this great fold line, the area of comparatively level land in the islands is very small, and amounts to only one-quarter of the surface area. Three lowland areas are of marked importance, viz., the Kwantō Plain upon which Tokyo and Yokohama stand, the Kanai Plain which holds the large industrial populations of the Kyoto-Osaka district, and the Nobi Plain of which Nagoya is the centre.

On account of the unstable nature of the crust in this region earthquakes are remarkably frequent, and about 1,500 shocks are recorded every year. The Pacific side of the main islands is more susceptible to these disturbances than the inner line. The most destructive shock in the world's history occurred on this side in September, 1923, when 91,000 people lost their lives and enormous damage to property occurred. At least fifty active volcanoes are known to exist in the islands, but many more are merely dormant. Hot springs are found everywhere.

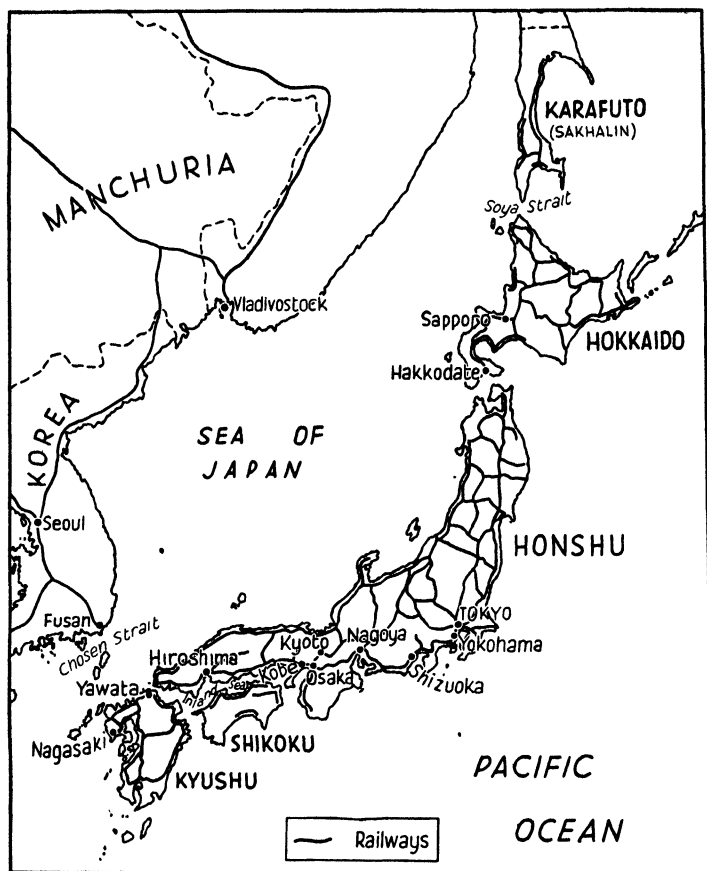


FIG 147. Japan, showing railway network.

2. Climate

The winds operating over Japan are affected by the indraught to the continental low pressure area in summer and by the outflow from the continental 'high' in winter.

The westerly winds of winter are very much stronger than the easterly winds of summer. As a result of this system of air circulation there are two distinct climatic regions; owing to the relief of the country, the 'front' (Pacific) and the 'back' (Japan Sea) coastal regions are affected very differently. The north-west winds blowing across the Japan

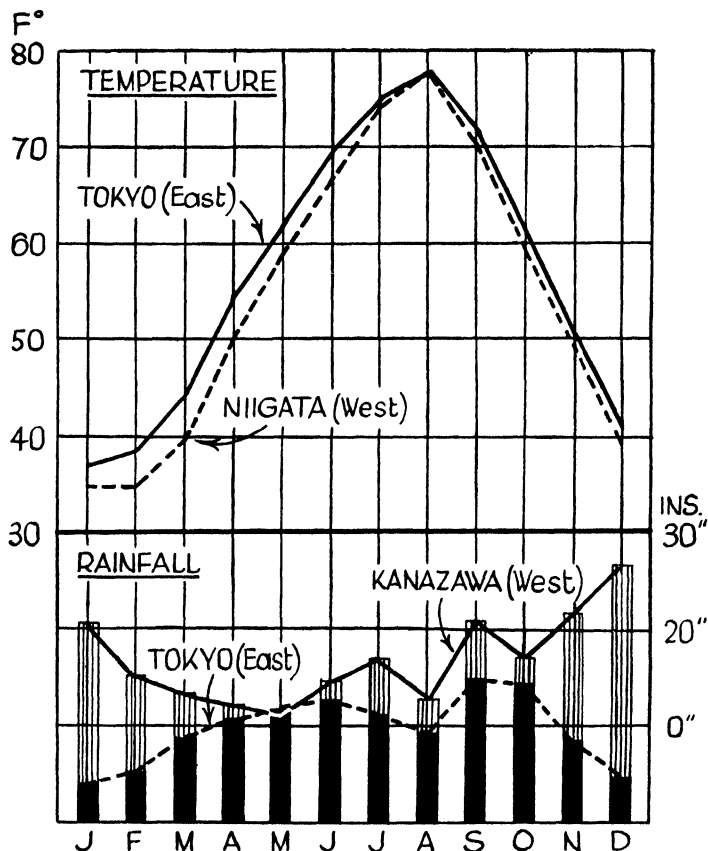


FIG. 148. Japan—Temperature and Rainfall for selected stations.

Sea bring much rain and snow to the 'back' region during the cold months from October to March. However, although the west coast is exposed to the full force of the cold winds from the Asiatic mainland in winter, it is warmer than the east coast. This is due to the nature of the ocean currents operating along the shores of Japan during these months. A branch of the warm Kuro Siwo hugs the west coast, while the east coast is washed by the cold Okhotsk current coming from the north. The south-east winds begin to blow about May, reach their height in August, and die away in September and October. These bring rain to the east coast, therefore, during the summer months. Thus the wet seasons of the two coasts alternate. A curious feature of the rainfall of the eastern coast is that there are two maxima, one occurring in June, the other in September. This can be seen in the rainfall figures for Tokyo shown in the graph. A fair indication of the shift in wind direction can be seen in the following directions of prevailing winds at Hakodate for the twelve months, viz.: W., W., W., W., SE., SE., SE., ESE., E., N., W., W. Japan is, however, much subject to cyclonic disturbances both from the northern and tropical areas, and typhoons often cause serious damage from July to October.

Mention has already been made of the influence of ocean currents on the climate of Japan. A branch of the warm Kuro Siwo Current flows along the west coast into the Japan Sea; another branch runs along the east coast, but in winter may be displaced as far south as 37° by the cold Okhotsk Current which washes the northern shores of Japan.

3. *Vegetation*

Vegetation and agriculture are closely controlled by these climatic influences. The forest areas, in particular, show the general variation from north to south. In the southern area

conditions exist that are almost tropical in certain months, and the vegetation typified by the bamboo shows this very clearly. In the central region sub-tropical conditions induce the growth of characteristic evergreens such as the camphor



FIG. 149. Japanese farming area on Honshu, main island of Japan.

tree. In the cold temperate conditions farther north, and in the mountain sections, the conifers are most prominent, and these forests are extremely important to Japan. A tree of great importance is the white mulberry, the leaves of which feed the silk-worm larvae whilst the wood is used for making paper.

So mountainous is Japan that only one-eighth of the whole surface is cultivated, but the volcanic soils, especially those of the old craters such as Asama, are exceedingly productive. The pressure of population on the farm lands is heavy; 76 per cent. of all cultivated land is under foodstuffs. Rice growing is the chief form of cultivation and more than half the agricultural area of the country is planted with this grain. Other food crops are wheat, barley, oats, vegetables, beans, potatoes and fruit. The chief use of the land other than this is for industrial crops, such as hemp, tobacco, and the paper mulberry.

4. *Minerals*

Japan is comparatively poor in minerals, and affords a great contrast to the countries on the American side of the Pacific. The mineral resources of the islands are sufficient to provide Japan with her requirements for industry in only one instance, that of copper. Coal, iron and petroleum are notably deficient. In addition, the deposits of both coal and iron are not of the best quality. This poverty in minerals has an exceedingly important effect upon Japan's development, and went a long way towards explaining her interest in the Asiatic mainland, and particularly in Manchuria and Shantung, where these two minerals are abundant. Coal is found chiefly in Kyushu, northern Honshu and Hokkaido.

5. *Population*

Japan Proper was estimated to have a population of about 80 millions in 1949, and the density of population on the lowlands is about 2,500 to the square mile. This means an intensity of cultivation that is scarcely credible in European countries. The average size of the Japanese farm, which has to support a typical family of six or seven, is $2\frac{1}{2}$ acres.

Every available foot of land has been brought under cultivation, and no effort is spared to bring the land to its utmost production. In about fifty years the population of Japan has doubled, and the yield of rice has been doubled also. But the limit has now been reached, and since 1947 an extensive plan of reconstruction for better production has been put into operation. An increasing amount of emigration has taken place in the past to all parts of the Pacific, but particularly to the Philippines, Hawaii, and Manchuria. The great pressure of human beings on the land in Japan accounts for the very small numbers of live stock. Animals are too expensive to keep, except for the necessary farm and transport services.

A considerable proportion of the people of Japan are 'cultivating the sea' either as fishermen or in the large pre-war fleet of Japanese merchantmen. Fishing is one of the most developed industries in the Japanese islands, as it is right through the Orient, and fish largely takes the place of meat in the diet of the people. The Japanese Government has made great efforts to stimulate whaling, especially in the South Pacific. The Japanese whaling fleet was second only to that of Norway before the war. Whale meat is an important item of food supply in Japan. The meat substitute, however, is in many cases the wonderful soya bean, which is to the Asiatic all that the coco-nut is to the Polynesian.

Japan's greatest single industry is the cotton industry. During the last decade the silk industry, which had formerly held this position, declined in both absolute and relative importance. At the same time, the new branches of the textile industry, cotton, woollen and rayon, were expanding rapidly. Unlike silk, these newer textile industries have to import their raw material. However, the most astonishing

feature of Japan's recent industrial development has been the expansion of the metal, machinery and chemical trades. This group is now as important as the textiles. Then there



FIG 150 A Japanese Tea Garden.

are the traditional industries such as the manufacture of glass, pottery, porcelain and lacquer-work, some of which show exquisite craftsmanship.

The principal cities of modern Japan are all in the manufacturing regions. The chief of these regions is the district at the head of the Inland Sea, where, in particular, the great textile industries are situated. *Osaka* (3,500,000) is the 'Manchester of Japan.' Here the textile trade has its headquarters, and cotton is the chief speciality. Other important industries have been established here. *Kyoto* (1,177,000), in the same region, is a modern city with textile, chemical, and porcelain manufactures. As the former capital, the city has much historic importance. The port for this region is *Kobe* (912,000), which is now the second

port of Japan. The second great manufacturing area lies around *Tokyo* (6,581,000), the capital and a large industrial centre. Since the great earthquake Tokyo has been largely remodelled and takes its place as one of the principal cities in the Pacific Basin in point of population and importance of industry. Its port is *Yokohama* (866,000), which also suffered severely in 1923, but is now a fine modern port protected by extensive breakwaters, and equipped with modern cargo-handling devices. It is the chief port for the silk trade, and for many other important industries. *Nagoya* (1,249,000), an important railway centre and chief town of a silk-producing area, and *Hiroshima* (310,000), a



FIG. 151. Mixture of Oriental and Occidental architecture in a Japanese street.

port on the Inland Sea, are other cities of the south. *Hakodate* (208,000) is the chief city and port of the island of Hokkaido. *Nagasaki* (212,000) is an important steel-making and shipbuilding centre in Kyushu. As the outlet

for the coal of the region, and because of its situation, the port was the chief naval base of Japan until the collapse.

After the defeat of Japan in 1945, a major part of Allied policy was the destruction of her war industries. Great factories were dismantled and whole industrial areas thrown into disuse. It soon became clear, however, that Japan's industrial system was geared into the larger economic structure of the nation; and that the farms of Japan depended upon the purchasing power of the people working in factories, who in turn depended largely on the farmers to buy their products. Moreover, in modern times, nearly all manufactures have become war industries especially the heavy industries such as steel and shipbuilding, and the textile and chemical industries. In addition, the people of the Orient cannot get along without Japanese goods which are produced at costs lower than those of Europe and America, and are more within the lower incomes of Asian peoples. The policy of dismemberment has, therefore, now been halted.

KOREA AND FORMOSA

1. *Korea* (or Chosen)

This mountainous peninsula is not extremely fertile, but it is inhabited by a very advanced branch of the Mongolian race. Agriculture is at a very high level, but other developments hardly correspond. Korea became after 1904 a province of Japan, whose tremendous and successful efforts to modernize the industry and transport of the country were not appreciated by the Koreans who are now independent.

The population numbers about 23 million and is mainly engaged in rice-growing and other branches of agriculture. There is a surplus of food-stuffs, mainly rice and soya beans, and this together with the raw cotton produced here moves

through *Fusan*, the railway terminus at the southern end of the peninsula. The ancient capital is *Seoul* (Say-ool), on the western side of the peninsula.

2. *Formosa* (or Taiwan)

This is an island of two distinct regions off the coast of China, of which it is again a province. The eastern and smaller section is exceedingly mountainous and thickly forested. It is inhabited by wild aboriginal tribes which live and work in a very primitive fashion, but the economic importance of the region is very small.

The western half is a plain area, well watered and largely composed of sediments washed down from the volcanic mountain areas. The chief products are rice, tea, sugar, sweet potatoes, ramie, jute and camphor. Exports of rice, sugar, fruit and camphor to Japan have been greatly increased in recent years. As a result of the changed political situations in China and Japan, Formosa seems about to become a vital strategic area.

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PART VII

NORTH AMERICA

CHAPTER XXVIII

GENERAL SURVEY OF THE PACIFIC COAST

ANY study of the section of North or South America washed by the Pacific must be first and foremost a study of the great plateau region which lies immediately behind the coast for the whole length of both continents. To describe this vast upland region as a series of parallel ranges or as an alpine block would still leave the factors of height and extent unappreciated, and the description of the great up-thrust of the surface through the length of the Rockies and Andes as a plateau region is more in accordance with the facts. In North America two main fold-lines cross over from Asia; one, a continuation across the narrow Bering Strait of the heights of north-east Asia, and the other the much more definite line through the unstable volcanic Aleutian Islands. As the Alaska Mountains this Aleutian fold hugs the curve of the Gulf of Alaska and then breaks off into two lines. That nearer the coast is lower, less clearly marked, and much breached by the sea; but it can be distinguished through the fringe of islands along the coast and lengthwise in the island of Vancouver, whence it continues as a low maritime ridge along the shore-line and right down the length of the Peninsula of Lower California. The second line into which the Aleutian fold breaks becomes the bold alpine series known in succession from the north as the Coast Range, the Cascade Range, and the Sierra Nevada—the series which forms the western rim of the plateau area.

The other main fold-line which can be traced from Asia

lies still farther inland; and, becoming much higher south of latitude 60° , it swings gradually eastward to form the inside rim of the broad plateau which attains a width of 800 miles behind San Francisco. This tableland is, in general, tilted towards the Pacific; and on their way to the sea the streams have had to break through the western wall and, in some cases, through the maritime ridge also.

The chief lowlands along the Pacific coast belong to an almost continuous north-south valley which lies between the maritime ridge and the western wall of the plateau from Vancouver to the Gulf of California. The three major sections of this depression are the Fraser-Columbia-Willamette valleys in the north, the Sacramento-San Joaquin valleys in the centre, and the head of the valley, now mostly drowned, known as the Gulf of California. Economically this last lowland area is of lower importance on account of its excessive dryness; but the other two valley regions contain most of the agricultural area, and consequently most of the people of the Pacific side of North America.

Certain features of the great mountain region and of the enclosed lowlands may now be broadly treated. To the north is the wide depression between the two main fold-lines down which the Yukon makes its way to the Bering Sea. Around the lower course of the Yukon, and along almost the whole Alaskan coastline fronting Asia, is a low-lying coastal plain which resembles the northern prairies on the Arctic coast. From the Aleutian corner right down to Puget Sound, the entire coast of Alaska and British Columbia is a long sunk-land where the deep alpine valleys have been drowned, forming fiords on an even grander scale than those of the South Island of New Zealand or of Norway. The Californian coast, on the other hand, is mainly a raised region; indeed, in certain areas, the upward movement is still in

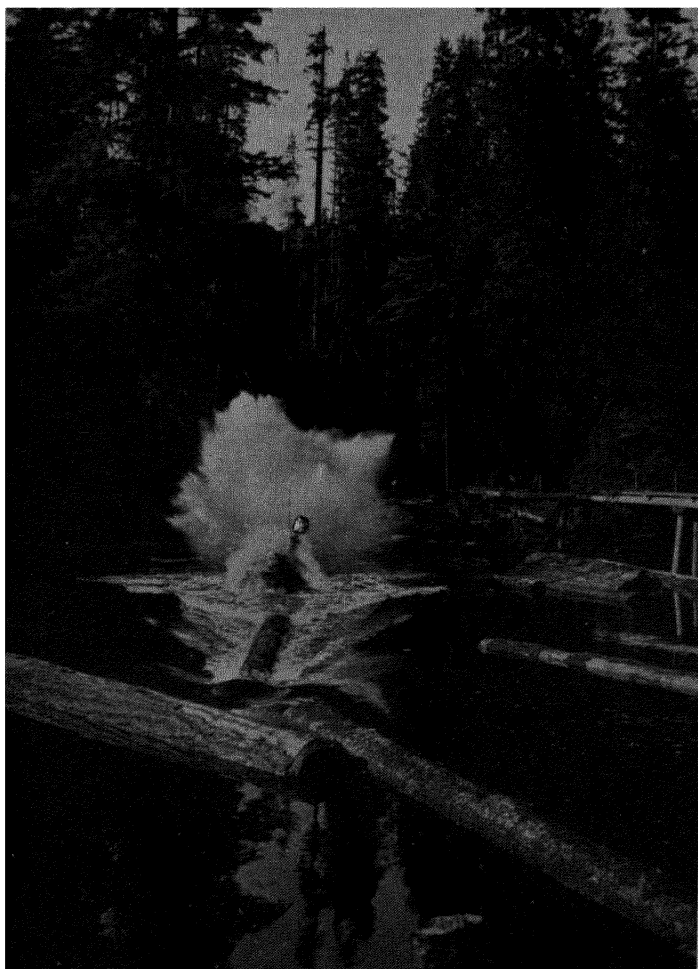


FIG. 152. Lumber slide in British Columbia, typical of methods from Alaska to Puget Sound.

progress. The coast-line here is vastly different in character and outline from that farther to the north.

The chief rivers of the west have gouged deep canyons in the plateau. For the greater part of their courses, owing to the general trend of the ranges, these rivers have a northerly or a southerly direction which usually changes abruptly where they break through the western wall in a series of gorges. On the Pacific edge of North America, to a greater degree perhaps than anywhere else in the world, the political boundaries run counter to the natural frontiers. In every case, between Canada and Alaska, between Canada and the United States, or between the United States and Mexico, they must be entirely disregarded in treating the geographical regions.

The presence of this great plateau means more than can be understood to the life of North Americans. In the first place, these high elevations have for long ages acted as traps for the moisture coming from the Pacific. It piles up above the snow-line to melt in the summer when the dry lands of California most need the water for irrigation, or to form huge glaciers which feed continuously the Pacific rivers farther north. Secondly, the constant rainfall along the seaward slopes north of 40° has made possible the rich forests upon which so large a section of the peoples of the Pacific Basin are dependent in so many ways. Again, the force of these streams in their rapid descent to the sea is a power that man is gradually harnessing for his use by changing the force of falling water to electricity. Engineers calculate that in the Pacific north-west of the United States alone there are undeveloped sites capable of generating upwards of 50 million horse-power. The possibilities for the industries of the future are tremendous, especially in the application of this power to saw-mills, pulping-plants, and the extraction

of ores. This brings us to the fourth great endowment of the region, the rich store of mineral wealth in the rocks of the plateau which is at present only partly known.

In sober fact very few regions of the earth's surface are so favoured in respect to climate, production, power, or scenery. From the richly productive fisheries of the northern fiords to the wide Mediterranean fruit lands of California, and from the gold of the mountains to the grain of the valleys, there is a range of products of which few lands can boast. The saddening feature will be impressed at every turn that man has not used this precious endowment wisely. For many years, he was engaged in 'skimming the cream of a continent,' as Russell Smith has put it, for his own large profit, to the complete disregard of the people of the future and the rights of the State. The planning of resource utilization and the conservation of natural resources has now become a continuing programme of the Administration of the United States. In other cases, such as salmon preservation, international co-operation between Canada and U.S.A. is gradually developing. Early in the present century Congress began to set aside large areas of forests in all parts of the country in which lumbering was to be carried on systematically, and scientific forestry practised. But the mere prevention of waste is not sufficient; it is necessary to plan the development of resources. Many such agencies have been established in the United States, of which the Pacific Northwest Regional Planning Commission is representative.

Lastly, partly as a result of war in the Pacific, and partly because of the peace-time needs of all peoples in the Basin, great manufacturing industries from textiles to films, and from ship-building to aircraft fabrication, have become established in Canada and the Pacific States of U.S.A. A complementary economy of the East and West Pacific has been born.

CHAPTER XXIX

ALASKA AND THE NORTH COAST

ALASKA is vast and varied. It is equal in area to four Swedens, five New Zealands, or six United Kingdoms. Within an area nearly the size of the state of Queensland it embraces a great variety of surface and vegetation—lofty Alps, deep fiords, enormous forests, large expanses of upland grazing, rich agricultural valleys, coastal waters teeming with fish, vigorous rivers pouring down water power—all as yet comparatively undeveloped. Its fur-bearing animals have attracted the trapper for 200 years or more; while deposits of gold, antimony, lead, chrome, manganese, nickel and many other minerals await the miner's enterprise.

The hardships suffered by the unseasoned diggers in the gold rush to the Yukon in the 'nineties have done much to defame a climate as good as Norway's near the coast, and no worse than Russia's in the interior. Before the war the people of Alaska numbered about 70,000, and the increase was slow owing to the retarding effect of poor communications upon development. Five years of war did more than fifty years of desultory development to reveal the possibilities of the territory. Alaska became a great springboard for the attack upon Japan. Unlimited men, money, and machines have changed Alaska from an empty snowbound region to a pioneer country with modern communications—roads, aerodromes, telegraph and radio services. A great new national highway, 1,600 miles long and costing £40,000,000, has been constructed; and this could be the first of a series of transport projects which will link U.S.A. and the U.S.S.R. Now, with soldier settlement a great post-war project, Alaska is 'on the map in a big way.'

With some inaccuracy, Alaska may be broadly treated as falling into four divisions: (i) the Arctic lowlands; (ii) the Yukon Valley; (iii) the mountain areas; and (iv) the Pacific Coast.

1. *The Arctic Lowlands*

These are really a small part of that vast tundra region stretching across the whole of northern Asia and North America, and what has been said of the Asiatic side also applies fully to the lowlands of Alaska. Slightly more favourable climatic conditions, however, here support a considerable amount of animal life of various types, but especially of the deer family. The caribou, the musk-ox, and many fur-bearing animals have attracted trappers and hunters since the land was discovered. The nomadic Eskimo tribes living in the region have proved that it is possible for man to live, and to live comparatively well, in these Arctic lands; and explorers such as Stefansson have taken up the defence of what is commonly considered to be an extraordinarily desolate country. The Government of the United States, of which Alaska is a dependent territory, has given a considerable amount of attention in recent years to the possibilities of pasturing reindeer, and of developing a system of agriculture suited to the short hot summers and cold winters. The road-building and aerodrome development of war projects have done much to open the country and to organize information services. The chief settlements consist of fur-trading stations of which the chief is *Nome*, and of Eskimo communities along the coast.

2. *The Yukon Valley*

The lower part of this valley is a broad flood plain 5,000 square miles in extent, but its grave climatic misfortune is that it opens on the cold Arctic seas, rather than on the

warmer northern Pacific, from which it is shut off by the high wall of the Alaska Mountains. The valley itself is mainly forest-covered, but the trees become thinner and disappear towards the tundra areas and the higher slopes. The rainfall, or rather snowfall, is comparatively light; and great climatic extremes are experienced. The lowest recorded temperature reached 54° below zero, and the highest 100° above. The valley has been called the 'Finland of America,' and attempts are being made to establish cultivation based upon hardy crops such as barley and potatoes. Despite careful scientific experiments the land remains underpopulated, and is likely to be so for many generations to come. Russian experiments in crossing wheat and rye may do much for this area.

3. *The Mountain Areas*

These are extremely rugged regions of almost everlasting snows and great glaciers. Transport under ordinary climatic conditions would be very difficult, and even railways would be of little use in this vast upland. Air transport may ultimately do much to assist development here. Much mineral wealth is undoubtedly lying here untouched, and the gold production of the palmy days of Klondike and other fields may yet be repeated.

4. *The Pacific Coast*

For convenience, this section of the coast is taken to extend as far south as Vancouver Island, although there are considerable climatic and other differences between the northern and southern sections. This area is really a great sunk-land which runs from Bering Sea to Puget Sound. The heavier precipitation of past ages eroded deep valleys in the young Alpine mountains which form this coast; and, when the subsidence took place, these valleys were drowned, forming

the fretwork of innumerable fiords that now constitute the shore-line. Some of these fiords are more than 2,500 feet deep and run between their rock walls for 200 miles into the heart of the Coast Range.



FIG. 153. A fleet of salmon-fishing boats in tow, typical of the industry in Alaska and British Columbia.

Extending from the north-west corner of the continent is the 500 miles of the rocky Alaska Peninsula from which, as from a peg, hangs the festoon of the Aleutian Islands. The islands are volcanic, and contain some of the largest active craters in the Pacific region. Off their shores the cold Arctic currents meet with the warmer Pacific circulation, and this gives rise to fogs for almost the whole year round.

Piled up on the lofty ranges behind the coast are the great glaciers that fill the upper valleys, and, in some cases towards

the north, reach right down to the sea. The fronts of these glaciers are constantly breaking up into lumps that float off as icebergs, to the serious danger of navigation in this part of the world. The whole seaward slope is comparatively steep; but, exposed as it is to the wet winds from the Pacific, it is covered with a forest composed mainly of pine in the south and of spruce at the northern end.

The natives of this area are a people intermediate between the Eskimoes and the American Indian of the Great Plains. All three are Mongolian in origin, and probably came to



FIG. 154. SEA HARVEST

Scow load of freshly caught salmon ready to be unloaded at the cannery, Skeena River, British Columbia. The chief difficulty is to ensure that the catch is not excessive, and the governments of Canada and U.S.A. have passed laws to prevent this. Passing laws is one thing; policing them is another.

North America by way of the Aleutian bridge before the great subsidence. In many ways, such as hardness, adaptability to a cold environment, methods of community life, and character of houses, weaving, and carving, the Indians of this coast resemble the Maoris of New Zealand.

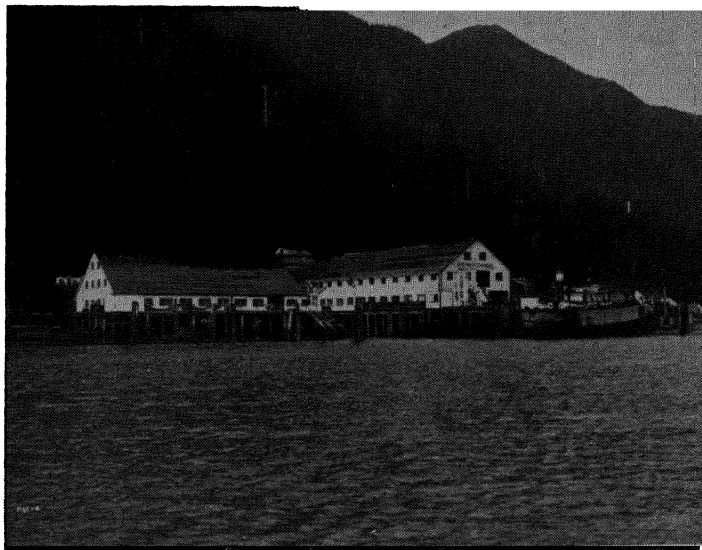


FIG. 155. FISH FACTORY

The Inverness Cannery, Skeena River, British Columbia. A most efficient factory for reducing fish to tinned food, for export all over the world. Note the steep and densely timbered hillsides in the background.

The occupations of the coast regions are mainly three, fishing, forestry, and mining. Of these fishing is easily the most important. The industries depend upon the world's needs for food and fur, and so the salmon and the seal are as important here as wheat crops are to the people of the prairies. The salmon, in particular, has become the basis

of a great industry. The salmon is a deep-sea fish which returns in vast numbers to breed in the glacial rivers where it was born. As the shoals swarm up the western rivers during spring or summer they are netted and trapped in countless thousands, and canned for export to almost every country in the world. So great has been the havoc wrought by the fisheries that there has been a danger of extermination of these fish, and the 'run' and 'catch' vary very much from year to year. In 1937, the Canadian and United States governments established an agreement to prevent over-fishing in these waters. The fur seals, on the other hand, are found year after year in large numbers on the islands along the coast. Here again the unscientific method of killing threatened the industry with extinction, but an agreement between the governments of Russia, Japan, and Canada has made regulations for the sealing industry that have apparently checked the mischief.

Mining, as an occupation in this area, is not very prosperous, probably owing to the easier conditions of the other great mining fields of the Rockies. West of Mount St. Elias deposits of copper, gold, and coal are known to exist; but so far they are scarcely touched.

The chief settlements along the coast are *Skagway* and *Juneau* in Alaskan territory, and *Prince Rupert*, the terminus of a trans-continental line near the mouth of the Skeena River and the most northerly town in British Columbia. Prince Rupert (at present a small town) may some day be the grain port for the northern wheat lands of Canada.

CHAPTER XXX

THE PUGET SOUND-WILLAMETTE VALLEY

1. *Relief and Climate*

L YING between the Cascade Mountains and the maritime ridge is the most northerly section of the long coastal depression. In length about 450 miles, this depression commences in the south as the Willamette Valley, takes in the middle part of the Columbia Basin, and disappears under water to the north as Puget Sound. The lower valley of the Fraser also belongs to this depression. The comparatively low maritime ridge, here known as the Coast Range, shelters the valley from the excessive rainfall of the coastal strip, whilst the high wall of the Cascades conserves the rainfall in the form of snow, and feeds the rivers through the summer.

Generally speaking, the climate of this region is very similar to that of western Europe from Britain to the Baltic, and the typical mild winters and cool summers of all west-wind climates are the rule. According to the degree in which the lowlands are sheltered from or exposed to this westerly circulation, climatic conditions vary very widely. The official meteorologist of British Columbia said of his province: 'In some districts between the mountain ranges the rainfall is so light that irrigation is necessary, and maximum summer temperatures range from 90° to 100°; while on the west coast of Vancouver Island at Henderson Lake, which is situated immediately westward of a mountain, the precipitation in 1926 was 284 inches, which may make it the wettest place in North America.'

Most countries having a climate of this type are heavily

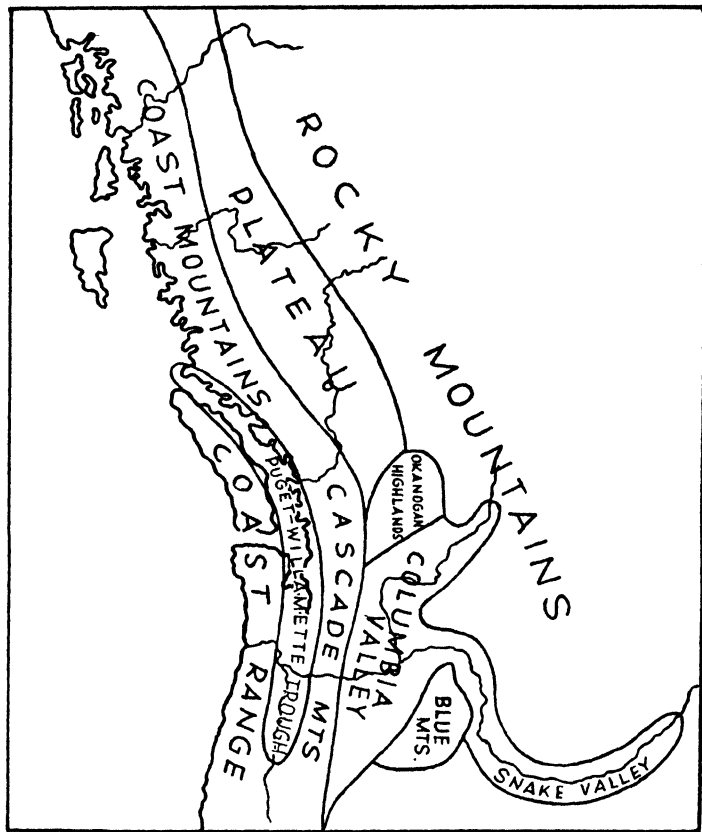


FIG. 156. THE PACIFIC NORTH-WEST

Major features of the build of the country.

forested; they comprise, in fact, the great temperate softwood forest regions of the world. For 1,500 miles, on this coast, hundreds of river valleys and thousands of hill slopes have been the nursery of great softwood forests. From the Douglas fir of the south to the Sitka spruce of the north there is a priceless treasury of timber here that has taken

centuries to grow. Settlement involves the removal of this forest, or at least parts of it. The problem is the same for British Columbia as for Tasmania; the same grave disadvantages are apparent, since settlement means usually the



FIG. 157. HAULING RED CEDAR LOGS, BRITISH COLUMBIA.

Tractors haul the giant tree trunks to the skidway which takes them on the first stage of their journey to the mill. See Fig. 152.

reckless despoiling of regions that are natural forests, and in most cases can be nothing else. The tendency after deforestation is for the soil to be washed away from the slopes, especially in the more hilly country. The problems of settlement increase in the wetter regions to the north. The whole valley region, however, is a good mixed farming area, and the climate is very suitable for dairying. The

crops, too, are the usual temperate climate grains, from the hardy barley and oats in the north to the wheat of the southern valleys; and this is combined with much stock-raising.

After timber, it is as orchard country that the area makes its chief claim. The absence of frosts at budding time owing to the diffusion of mild oceanic conditions far inland, and the shelter from heavy winds in valley situations, provide

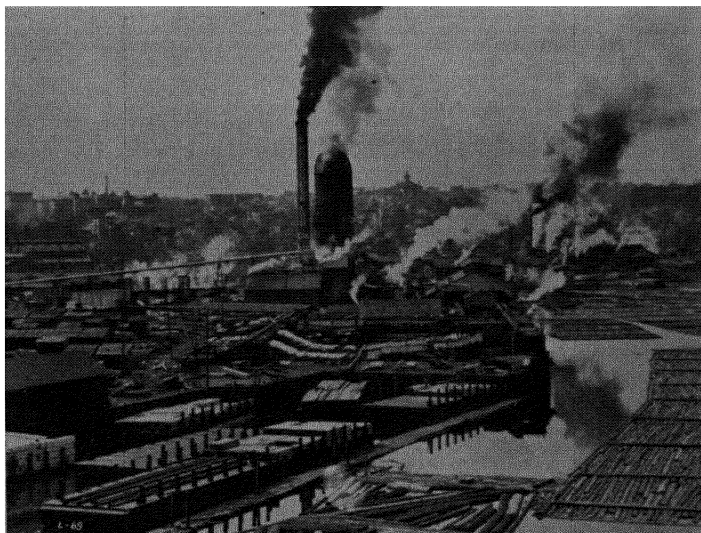


FIG. 158. PULP AND PAPER MILL, VANCOUVER

The rafts of logs arrive at the mill. Note the convenient location of the mill; logs are floated down, and deep sea ships can call for the timber.

the ideal situation for apples, pears, plums, and other fruits. In addition the small fruits of the berry family are all well suited here, and the cultivation is extensive. So it is a very

natural development that all the valleys opening on the Puget Sound, just as the eastern and northern valleys of Tasmania and of the North Island of New Zealand, have become great fruit-producing areas. Similarly, the chief factory industries are jam-making, fruit preserving, canning, and pulping, and the preparation of fruit juices.

The greatest industries of this region, however, are connected with the forest. In these days saw-milling has to be compared with steel-making because the raw material is so massive and such huge mechanical appliances are needed to deal with it. So we find that the modern development is to place the great mills on the water front, where the logs can be floated down and where the deep-sea ships can come for the timber. Running back into the forest from lake, river, or the mill itself are the tramways down which the giant logs come in sections—a tree to a train—to be torn and sawn and shaped for the timber markets of the world; or pulped to make the newspapers of six continents. The newest industry to commence another onslaught on the forests of the world is that of rayon or 'artificial silk' manufacture. This depends upon cellulose and the raw material is again wood-pulp. The chief consolation is that there will be less waste, since what the timber man does not use may become pulp for either paper or rayon. But even the mighty forests of the Pacific coast cannot meet these demands for many years at the present rate; and the day must come soon when the world will have to ration its softwood supplies.

From the industrial point of view the chief advantage of the region is the immense power available in the streams of every valley along this coast. Oregon, Washington, and British Columbia have all turned this force to account in developing electric power for mills, and great extensions

are constantly being planned. So far its use is confined mainly to the industries connected with timber and paper, and to driving machinery in local works such as jam factories, canning works, flour-mills, and engineering shops. Because of her great water-power British Columbia may

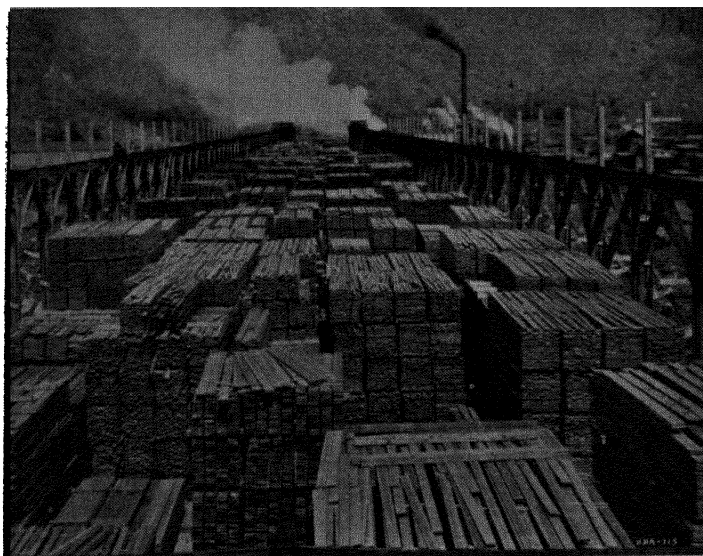


FIG. 159. Eight million feet of Douglas Fir lumber ready for the export trade.

yet become the chief manufacturing area of the North Pacific as New Zealand may for the South.

The main gateways of this region have acquired a double importance as collecting and distributing centres for the trade connected with the interior, and as manufacturing centres, since the great development of the age in connection with big ports is the tendency for manufactures to migrate to the sea-board. *Vancouver* (300,000) is situated on

Burrard Inlet, a splendid land-locked harbour near the mouth of the Fraser. It is the largest Canadian port on the Pacific coast, and being ice-free for the whole year is the chief port of Canada for certain months. As a growing

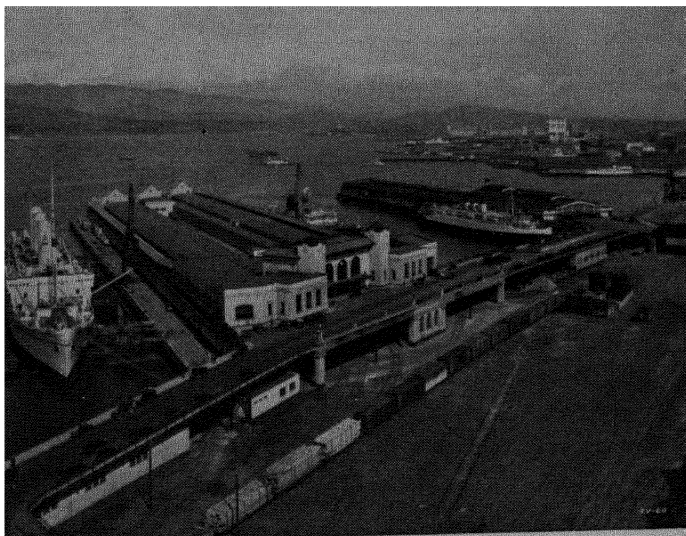


FIG. 160. HARBOUR DOCKS, VANCOUVER

Two great routes, trans-Pacific and trans-Canadian, meet here.

industrial centre it derives its power from several sources, but chiefly from Stave River and Lake Buntzen, 42 and 16 miles away respectively. Another big plan to derive power from Bridge River and other schemes will give the area 700,000 horse-power for industrial purposes. As the terminus of the most important Canadian trans-continental lines, Vancouver has become the chief Pacific grain port for the prairies.

New Westminster (18,000) is an important saw-milling and wood-pulping centre on the lower Fraser, and a grain port.

Victoria (65,000) on a harbour at the southern end of Vancouver Island, is the capital and administrative centre of British Columbia. It depends mainly on industries connected with timber, and on the agriculture and dairying of the eastern side of the island.

Seattle (370,000), the capital and main port of the state of Washington, is situated on the wonderful waterway of Puget Sound, 150 miles from the open sea. It is the terminus of two trans-continental lines and regularly ranks third (in tonnage) among the Pacific ports of the United States. An important ship canal has been constructed between the harbour and Lake Washington.

Portland (310,000), on the Willamette 12 miles from its junction with the Columbia River, is a port of a different type. It is the outlet for the two valleys and the chief rival of Seattle for the trade of the north-west coast of U.S.A.

Tacoma (100,000) at the head of Puget Sound is another important outlet, and is also the chief lumber-manufacturing city of western United States.

CHAPTER XXXI

THE FRASER-COLUMBIA VALLEY

1. *Relief and Climate*

A SECOND valley region lies between the Coast and Cascade ranges on the west and the Rockies proper (Selkirks) on the east. It embraces the upper and middle valleys of the Fraser and Columbia rivers. Most of the area is a plateau region dissected by the deep gorges of the two rivers and their tributaries. The Fraser Valley lies wholly within Canada, and its area of cultivable land is considerably less than that of the Columbia Basin.

The whole area presents one of the surprises of the Pacific coast, and this is due to the arrangement of mountain and valley in relation to the wind-circulation, a situation which has already been discussed. The rain-bearing winds must cross the maritime ridge in Vancouver Island and the higher Coast and Cascade ranges before they reach the valleys, and consequently the valleys, especially on their western side, tend to dryness. Look at these rainfall figures for Henderson Lake on the west side of Vancouver Island, and Lytton in the middle Fraser Valley:

MONTHLY RAINFALL IN INCHES, 1926 (APPROX.)

	<i>Total</i>	<i>J.</i>	<i>F.</i>	<i>M.</i>	<i>A.</i>	<i>M.</i>	<i>J.</i>	<i>J.</i>	<i>A.</i>	<i>S.</i>	<i>O.</i>	<i>N.</i>	<i>D.</i>
Henderson Lake	284	23	40	14	13	21	4	14	5	7	49	38	56
Lytton . . .	12.5	0.7	2.8	0.4	0.2	1.6	0.9	0.1	0.7	0.5	1.5	1.4	1.7

It will be seen that there are almost desert conditions in parts of the valley; and, in general, the western sides are

better watered than the east slopes in the lee of the ranges. Kamloops sometimes gets less than 5 inches during the year. The rain falls chiefly during the colder months, and is associated with the cyclonic storms which sweep in from the Pacific during this season.

Something must be said here about irrigation and water power. The whole of the coastal region from Alaska to Oregon is marked by areas of high precipitation in the form of rain or snow; and in many places the engineer has harnessed the run-off for the generation of electricity, for irrigation, or for both. This mountain region has all the conditions which favour generation of water power—abrupt changes in height of land, abundant rainfall, natural reservoirs such as lakes, glaciers or snowfields, which maintain a steady flow in the streams, and favourable dam sites in narrow valleys. The hydro-electric power is used for a variety of great industries—saw-mills, paper pulp making, box-making, furniture industries, rayon manufacture, and many others. The states of the Pacific north-west have the greatest reserve of water power of any region in U.S.A. (about 40 per cent. of the total), whilst the proportion of developed water power is about 20 per cent. of the national total. The total area of Washington, Oregon and Idaho is about 157,000,000 acres, of which about 3,000,000 acres can now be irrigated. The Columbia River system is of the greatest importance for irrigation as well as for all other uses.

The great forest wealth of Douglas fir, ponderosa pine, hemlock, spruce and other species, in combination with this great hydro-electric power, provides the basis for industries which employ 120,000 people in the Pacific states of north-west U.S.A. alone; and the total value of the forest products from timber to rayon in these states is probably more than \$2,000 million a year.

The distribution of the rainfall over the region determines a definite arrangement of orchard, farm, and pastoral country. The dryness is not entirely a drawback, however, as the fertility is not washed out of the soils, and where

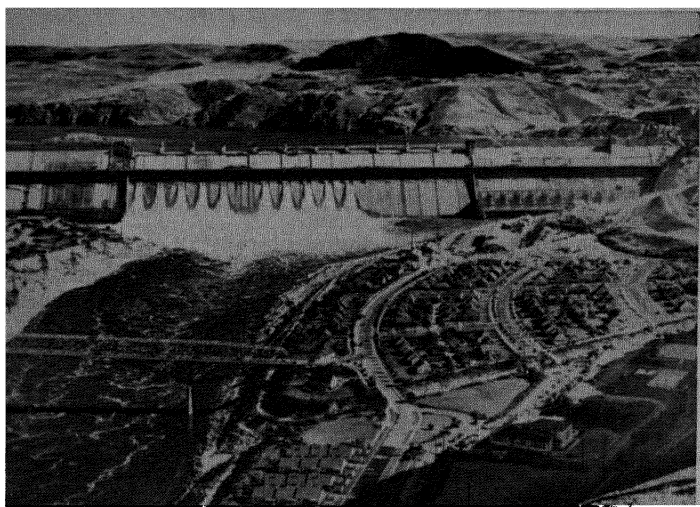


FIG. 161. IRRIGATION IN A BIG WAY

View of the Grand Coulee dam under construction. Notice the barren country which made irrigation necessary, the modern town constructed for the engineers and workmen and their families, and water rushing through the spillways. The dam is now the world's greatest single source of electrical energy and will ultimately reclaim 1,250,000 acres of arid and abandoned holdings.

irrigation is possible the land is very productive. The rolling hills of much of the Columbia Basin are in great contrast to the rocky Alpine areas of the Fraser, and this is chiefly a result of glacial action in past ages in both cases. The ancient glaciers scoured out the Fraser very cleanly, but in the Columbia Basin much glacial rubbish was left behind

and now forms good hill-farm country. The Walla Walla Plateau on the east of the Columbia region has great stretches of unproductive upland. The middle part of the basin is sufficiently far south to experience a fairly long hot summer; and, in addition, the lava flows of past eruptive periods have here weathered into comparatively rich soils. Thus soil and climate are both adapted for growing wheat, and the Columbian wheat lands yield an average of about 20 bushels to the acre compared with the 15-16 bushels of the prairies. The largest area of wheat country lies round *Spokane* (104,000), a railway centre which has become the trading and distributing headquarters for the whole upper Columbia Valley. The agriculture, stock-raising, and timber-cutting industries are its main support.

Washington State has become in recent years a great apple-growing area. That part of the Columbia Basin at the foot of the Cascade Ranges has been developed with the aid of irrigation into the orchard areas of the Okanagan, Wenatchee, and Yakima Valleys. The neighbouring Hood River Valley is a similar orcharding district. Most of the remainder of the Columbia Basin is natural grassland. In both the Fraser and Columbia areas the ranges are devoted to cattle and sheep raising. The chief difficulty in the way of agricultural development in the Fraser Valley is the comparatively small area of level land, and in this respect it much resembles Norway. The depth at which the Columbia flows across most of the upper basin is the chief drawback there. Water for irrigating the fertile uplands is there, but the expense of raising it is the chief problem.

Kamloops (6,000) is the chief settlement in the upper Fraser Valley. The chief crop of the lower part of the valley is apples, grown chiefly around Lake Okanagan, a glacial lake, some 40 miles in length.

CHAPTER XXXII

CALIFORNIA

1. *Relief and Climate*

THE dominant influence of the plateau region is maintained through the 750 miles of California. The main range, really a high plateau 75 miles wide, is here known as the Sierra Nevada. Its highest ridge is generally about 10,000 feet above sea-level, but Mount Whitney towards the south rises to nearly 15,000 feet, and is the highest peak in the United States. In contrast to the Selkirks, the slope toward the ocean is more gradual. Here, too, there are a number of valleys which lead to ancient deltas which now form rich plains near the coast, such as the plain on which Los Angeles stands. The maritime ridge, here known as the Coast Ranges, is about 50-60 miles nearer the coast and much lower than the Sierra. Between the two highland areas is the long narrow valley of California, a great depression once part of the Pacific but now filled with the sediments washed down from the enclosing mountains.

The position of this valley with relation to the wind systems is of importance. In summer a high-pressure area lies off the coast giving on-shore winds which might be expected to bring rain; however, these winds are cooled in crossing the Californian Current, and on becoming warmer when they blow over the land tend to absorb moisture rather than deposit it. After September, when the wind system has swung south with the sun, the high-pressure area off the coast tends to move further south or to disappear altogether, allowing the 'lows' of the westerly wind belt to move on-shore and bring rain. Most of the rain, therefore, falls between October and May, the remaining months being

a season of summer drought much like that experienced in the Mediterranean region, or in southern Australia. The highest rainfall, in places as much as 200 inches, is trapped

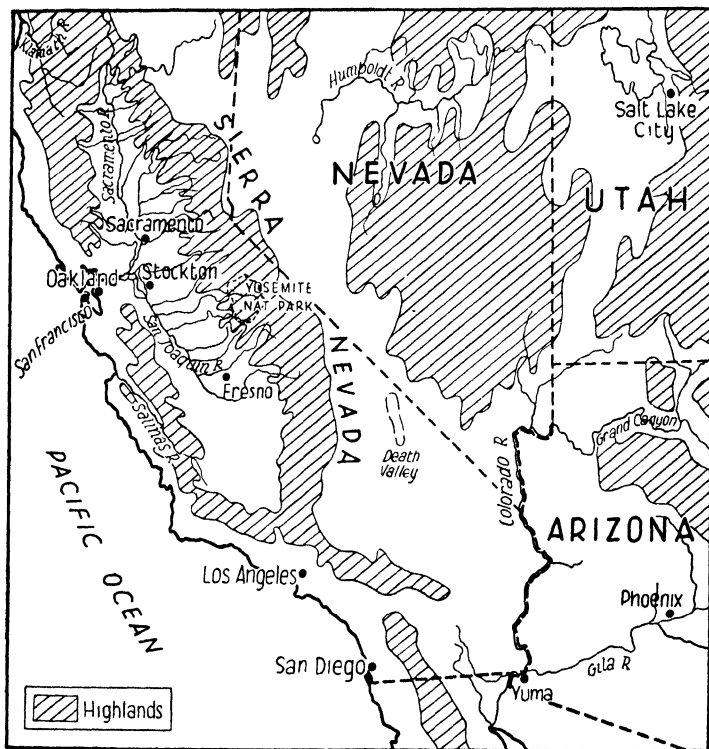


FIG. 162. South-western United States.

on the Sierra Nevada in the form of snow, another fortunate circumstance for the valley since the run-off from the melting snows fills the streams for the warmer season of maximum growth. But this run-off varies in a remarkable

manner, and provision has had to be made for storing and regulating the water flow in a large portion of the region. The valley itself is a dry area, tapering from 25 inches of rainfall in the north to 5 inches and less in the near-desert to

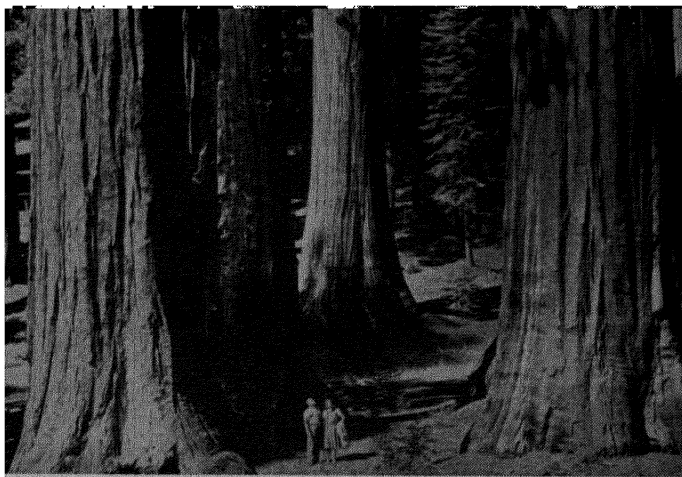


FIG. 163. GIANT REDWOODS, CALIFORNIA

These trees were growing when the Pyramids were being built, three thousand years ago. They are sequoias, but are usually known as redwoods. They, and the eucalypts of south-eastern Australia, have produced the tallest trees in the world.

the south. As a consequence, irrigation means as much to California as it does to Egypt. One other advantage from the presence of the plateau lies in the possibility of utilizing the water-power available in the ranges.

The Sierra protects the Great Valley from the cold inland winds of winter and the scorching winds of summer, and the valley is thus sheltered in a way that determines its chief use as a fruit-growing area. Rising from the valley floor, four zones of vegetation may be distinguished: (i) the

grasslands of the foot-hills up to about 1,500 feet, where rainfall is hardly sufficient for trees; (ii) the zone of drought-resistant vegetation, up to approximately 3,000 feet, especially characterized by the yellow pine; (iii) the zone of heavy rainfall and big forest trees, especially the sequoias (pron. *se-kwoy-a*), which shades off towards (iv) the summit areas where cold becomes too great for plant growth except of a stunted kind in sheltered situations. It is evident from this brief survey that the Sierra spells water, power, and timber for the inhabitants of the valley; and it would be no exaggeration to say that but for the Sierra California would be largely desert.

2. *Production and Settlement*

California is in many ways very similar to great tracts of southern Australia, and especially resembles the Murray River Basin. The San Joaquin (pron. *San Hwa-keen*) Valley might compare with the Murray Valley in a more fully developed stage. Further, California and Australia have gone through similar stages of settlement. In both there were the first stages of pastoral estates with population spread very thinly in the valleys, the frontier stage as it has been called. Then after 1849 came, for each, the period of the gold discoveries which did so much to stimulate interest in the new lands and to provide capital for its development in other ways. In both countries mining is now a declining industry. But here comes a great difference in the history of the two regions; the discovery of mineral oil in California has had no parallel in Australia. This has led to the development of great industries in the Californian Valley, and has given it an added importance in the commerce and trade of the Pacific. We may notice other likenesses between the Australian and Californian areas, the dependence upon

irrigation and upon artesian water, the character of the vegetation—a likeness that has been intensified since the wholesale introduction of the eucalypts and other Australian

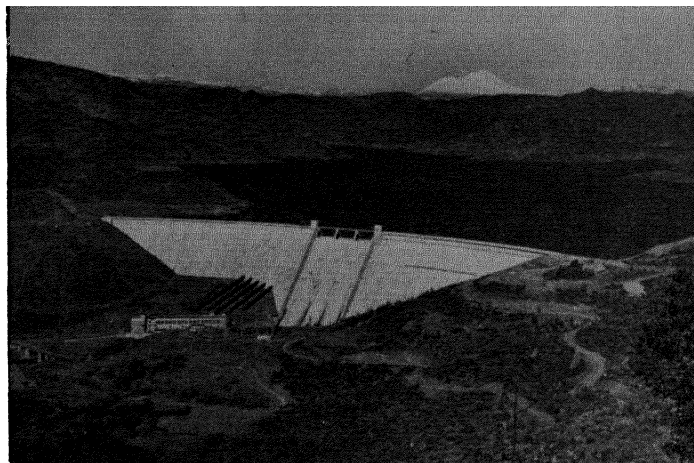


FIG. 164. NATURE'S WATER STORAGE,
CALIFORNIA

From the five glaciers and countless snow slopes of Mt. Shasta comes water to irrigate two-thirds of California's agricultural land. Two storages and 350 miles of canals will maintain 1,500,000 acres of vines and fruit trees, cotton, grain and vegetables. Flood and erosion control and hydro-electric power make Shasta dam a three-purpose scheme.

trees—and the outdoor life of the people, which is, of course, a climatic effect. A further result of the similarity is the fact that California and Australia are very often competing in the same markets as sellers of similar products.

Southern California does not properly belong to the Great Valley, but is a region lying between the plateau and the sea, and having in general a somewhat hotter, drier climate than

that of the Great Valley. A marked feature of the southern area has been the adoption of Spanish and Italian models in architecture. These types of building are particularly suited to the country, and Russell Smith has called the development 'a nice recognition of geographic influence.'

California is, for the most part, the Great Valley. Leaving Los Angeles, the main northern railway runs through barren canyons on the edge of the Mojave (pron. *Mo-hä-vay*) Desert and zigzags to the top of Tehachapi Pass. From here the line drops sharply for 3,000 feet to the floor of the Great

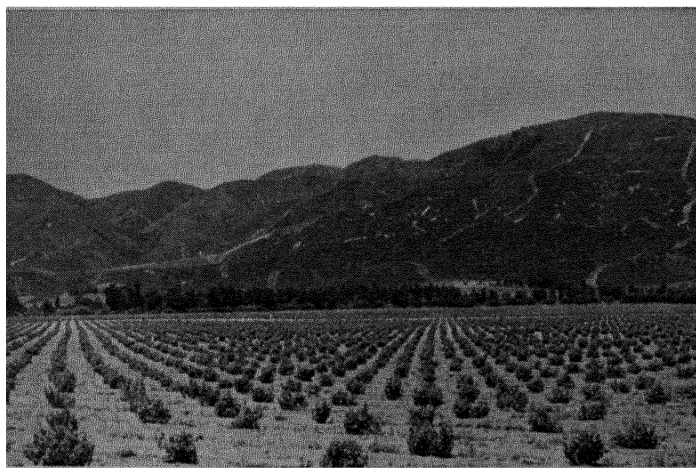


FIG. 165. IRRIGATED VINES, CALIFORNIA.

Tens of thousands of acres of grape vines cover the floor of San Bernardino Valley. This picture shows part of a 5,000-acre vineyard stretching from the sandy valley floor to the foothills of the Sierra Madre.

Valley, and runs in an almost straight line towards Stockton. Running back into the heart of the Sierra are the valleys carved out by the rivers which join the San Joaquin, the

main stream of the south valley. These spur valleys and the floor of the main valley are the areas irrigated by the run-off from the Sierras. Every 50 or 60 miles along the line the canning and packing sheds of a large town tell the



FIG. 166. CITRUS GROWING IN CALIFORNIA

The semi-dwarf orange trees have been bred and pruned to this standard shape. Taller trees surround the orange grove to act as a protection against cold winds.

story of the valley, even if 300 miles of irrigated orchards and vineyards have not already done so. *Fresno* (55,000) is the centre of the grape country and the headquarters of the important raisin industry. *Merced* and *Modesto* are the centres for fruit drying and canning. Every now and then along the line a great fruit express with a train of cars a mile in length passes on its way to San Francisco or Los Angeles. The longer, larger Sacramento River drains the north valley. From *Stockton* northwards to *Sacramento*, the rich delta

lands have become a great centre for the production of vegetables. North of Sacramento, to the production of fruit and vegetables must be added that of rice. Further north, the cultivation of wheat and finally the grazing of sheep becomes more prominent. On the seaward side of the Coast

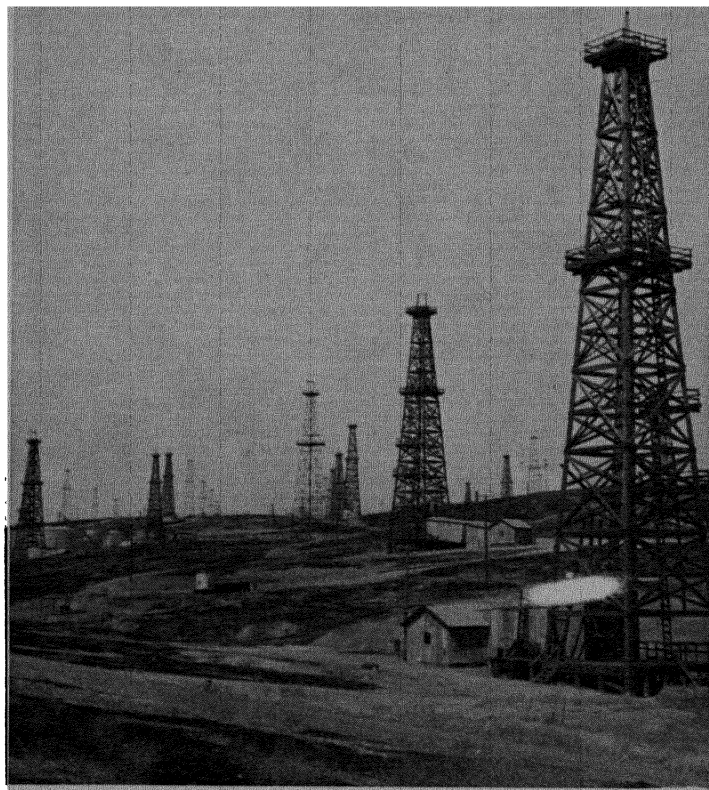


FIG. 167. OIL BORES NEAR BAKERSFIELD, SAN JOACHIN VALLEY, CALIFORNIA

One of the largest petroleum fields in the United States: it produced more than 100,000,000 barrels in 1946.

Ranges lie the Santa Clara and Salinas valleys where fruit production has specialized along certain lines. The Santa Clara valley produces one-third of the world's dried prunes, as well as peaches, pears, and vegetables. *San Jose* (pron. *San Hozay*), the chief city, has become such an important centre of the fruit-canning industry that it lays claim to being the greatest in the world.



FIG. 168. LAYING PETROLEUM PIPE LINE, SAN JOACHIN VALLEY, CALIFORNIA

The ditch is dug by a giant earth-mover: 60-foot sections of pipe are then placed and covered by special equipment.

Careful measures have to be taken to protect the vine areas from late frosts despite the generally mild climate. The lowest parts of the Great Valley, like the similar regions

of the Murray, have been reclaimed by levees, partly natural, and on these areas dairying is established. Rice is also cultivated very successfully under irrigation. One great difficulty is common to both the irrigation areas of Australia and



FIG. 169. PETROLEUM REFINERY, RICHMOND, CALIFORNIA

General view of a cracking plant. After World War II petrol was in short supply in most countries because of insufficient refineries.

California, viz., that of 'salting.' The irrigation water brings up salts in solution from some depth, and this collects near the surface when the water has evaporated. After a time the soil becomes too salt for plant life. This problem is being solved by various methods, especially overhead watering by giant sprays in place of channel watering.

San Francisco (690,000) is the main gateway of the Great

Valley. Situated on a magnificent landlocked harbour, it is the largest port on the Pacific coast, with great industries dependent upon the production of the back country, and with much 'through' trade to the eastern states from all countries of the Pacific. Among many other claims it is notable for its bridges and Berkeley University.

Los Angeles (1,510,000), the southern capital and university town, is also rapidly developing as an industrial and commercial centre. It is the centre of the film and other industries. Its port is at the artificial harbour of Port Wilmington. Water is brought 250 miles from the Sierra.

Sacramento (100,000) is the metropolis of the fruit and wheat region in the northern valley of the same name.

Stockton is an important rail and road junction at the mouth of the San Joachin Valley.

Fresno is the main fruit centre in the San Joachin Valley.

CHAPTER XXXIII

THE DRY LANDS

BETWEEN the Sierra and the wide sweep of the Rockies towards the east stretches a great arid plateau region stepping down from (i) the High Lands of Wyoming and Colorado to (ii) the lower levels of New Mexico, and rising again to (iii) the Mexican tableland. These are the three main divisions that approach nearest to the trade-wind deserts of other continents, and are most arid in the Mojave Desert and the Bad Lands of Arizona.

1. *The Utah Plateau*

Lying in the rain shadow of the mountains, this plateau, because of its general elevation, receives sufficient rainfall to maintain grasses and sage brush, and the area is thus a great natural pasture with scattered patches of forest. It comprises a region of inland drainage concentrated in the Great Salt Lake, the only out-flowing stream of any size being the Snake River at the north-western corner. Sheep and cattle raising, with cultivation in the irrigated oases, and copper, lead and silver mining in the ranges comprise the main occupations of the region. The lakes are the shrunken relic of one ancient lake, and are remarkable for their salinity. Many of them are often merely salt-encrusted mud-flats like those of Central Australia. The climate is much more continental in character; and, despite the high day temperatures, frosts are experienced right through the year in parts of the plateau.

The rich soils of the basins make for great fertility where irrigation can be practised; and *Salt Lake City* (155,000) is like Mildura, entirely dependent upon irrigation. Big storage basins support other agricultural and pastoral centres such as *Ogden* and *Carson City*. The Snake River area is an

old lava plateau that has been dissected by the streams which have carved out deep canyons. Here there is rich soil and water, but the water is such a depth below the level of the plateau that little cultivation is possible.

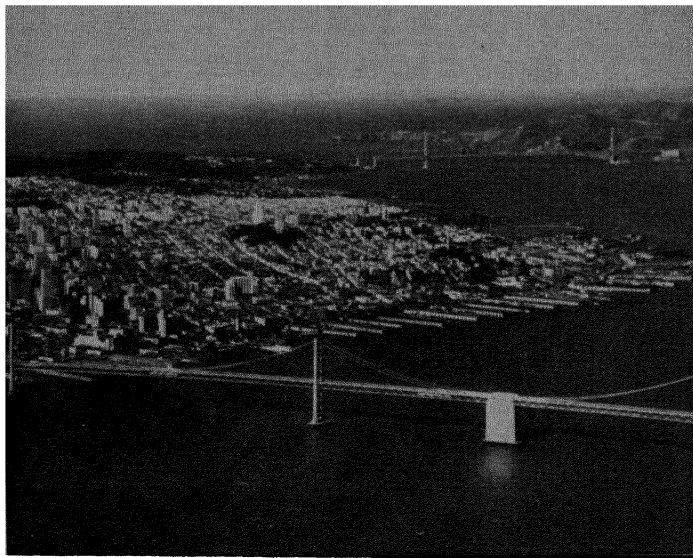


FIG. 170. SAN FRANCISCO AND HARBOUR

The harbour is formed by the "drowned" lower portions of the Sacramento and San Joachin Valleys. Air photograph of "The Bay" looking over the city and the two modern bridges, through the Golden Gate to the Pacific Ocean.

2. *The Great American Desert*

The driest parts of these areas are also the lowlands such as the Mojave Desert, Colorado Desert, Bad Lands of Arizona, Sonoran Desert, and Lower California. The rain falls mostly along the enclosing mountain rims. There is a remarkable range of comparatively useless vegetation over the whole desert, and the plants of the cactus family are very

prominent. Rain-storms are responsible for the remarkable erosion that is so pronounced over most of the area. But 'this region is by no means devoid of natural resources or human activity,' says a Government bulletin. 'It contains prosperous cities, fertile agricultural districts, forest-clad mountains, a large aggregate number of watering-places, some rich mines and an unknown wealth of mineral deposits. But the localities that have water supplies are widely separated oases in a vast expanse of silent, changeless, unproductive desert, whose most impressive feature is its great distances, and whose chief evidences of human occupation are the long roads that lead from one watering place to another.' The irrigation areas that exist depend on giant storages such as the Roosevelt Dam. A remarkable feature of the whole region is presented by the tremendously deep and long canyons which have been gouged out by the main streams, and these lend themselves to the purposes of the engineer in the storage of water.

The Colorado is the Nile of the American Desert through which it flows for 1,500 miles, draining 200,000 square miles of basin. Its erosive power is so great that it is gradually filling the head of the Gulf of California. The old head of the inlet is represented by Salton Sea, and the alluvial area between this and the sea has been reclaimed and irrigated, and is now the productive Imperial Valley. *Yuma* is the centre of another irrigation area in the lower Colorado valley.

3. *The Mexican Plateau and adjacent Coast*

Mexico is, in the main, a great triangle of tableland 760,000 sq. miles in extent lying about 6,000 feet above sea-level, with climatic conditions which vary from tropical to warm temperate in type. Its soils are, in general, hard and flinty and the arid conditions of the plateau resemble those of Spain. Towards the south-central or narrower end of the

plateau, where rainfall is greatest, most of the agriculture and most of the population of about 15 millions is concentrated. In this area wheat, maize, beans, barley, citrus fruits and vines are grown in the valleys and dairying is carried

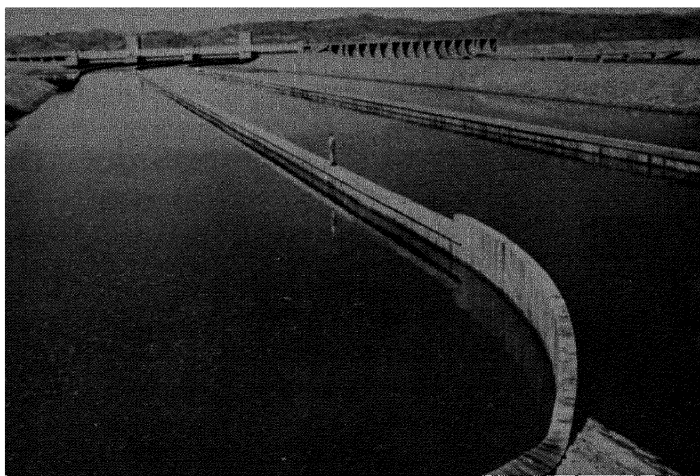


FIG. 171. DISTRIBUTING THE WATER

The distributing end of the irrigation scheme. Diversion canals starting the water on an 80-mile journey from the dam in the background to transform cactus and sagebrush country into the plantations and gardens of Imperial Valley.

on extensively. Sugar, cotton and tobacco are also produced on an increasing scale. In the northern section vegetable and grain crops are grown along the valley of the Rio Grande. The chief occupation on the dry uplands is cattle raising. The economy of the country is mainly agricultural and pastoral with relatively few factory industries.

The plateau contains rich and varied mineral resources and a large mining industry flourishes. The silver-lead deposits are most important. Mexico is the leading producer of silver and ranks third (after U.S.A. and Australia) in the production of lead. Antimony, gold, copper, platinum, mercury,

sulphur, coal and iron are continuously mined. Petroleum is also produced, 44 million barrels (each 42 gallons) in 1941, compared with 1,404 million in U.S.A. and 238 million in U.S.S.R. The exploitation of the mineral deposits by foreign capital has for long been a thorny question in Mexican politics.

Because of geography and tradition Mexico turns towards the Atlantic rather than to the Pacific; and, despite its economic and political significance, little more need be said here. The population falls into two main groups, that of aboriginal Indian descent containing four-fifths of the people, and the smaller property-owning or managerial group whose members claim Spanish ancestry. Although Mexico is one of the leading Latin-American republics, it is only in recent years that successive governments have concentrated upon social advancement and progressive educational policy. Considerable progress has been made in living conditions and industry since 1940.

Mexico City, with about one million people, is the capital and also the principal trading and financial centre. Its port is *Vera Cruz* on the Gulf about 200 miles distant. The picturesque situation and modern plan of the metropolis are notable, and it has become a favoured tourist resort.

CHAPTER XXXIV

THE PACIFIC COAST OF CENTRAL AMERICA

THE high backbone of mountain through Central America runs very close to the sea on its western side. As a consequence the Mexican and Central American tablelands are completely cut off from the Pacific by a continuous mountain wall; and there is scarcely a break of any kind along the whole coast-line from Lower California to Panama. In addition, these lands are in the area affected by the trade-

wind system which brings moisture from the Atlantic, so that the west coast is in the lee of the Sierras, and becomes in effect an extension to the southward of the dry region of Arizona and Colorado. Physically and economically Mexico and the Central American countries turn, therefore, towards

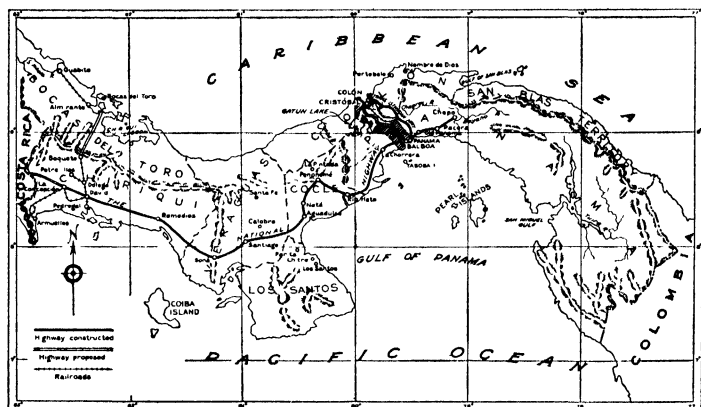


FIG. 172. Central America, showing Panama Canal.

the Atlantic; and the Pacific coast contains very few people and no industries of any importance.

The coast south of Mexico is, if possible, even more monotonous and arid than it is to the north. Along the beach runs a strip where the coco-nut palm grows naturally in its wild state. Farther back is a strip of grassland which supports a few cattle. In favoured situations above 3,000 feet appear the scattered patches of forest, mainly in the short deep upper valleys. Some of the lower valleys have been irrigated, and sugar-cane and other tropical crops form the basis of a scattered agriculture. A few small ports carry on an intermittent trade in copra and hides and even a little mineral ore from the highlands; but good harbours are lacking. The best port on the Mexican coast is *Acapulco* (5,000). The Pacific coast of Honduras has the best harbour

for the whole in the small Gulf of Fonseca, on which stands the port of *Amalpa*, mainly important because it is leased by the United States as a naval station.

The lowest part of the Sierra of Central America occurs at Panama, which is also the narrowest part of the isthmus. Panama naturally became the chief pass, therefore, between the Atlantic and the Pacific; and the mule-route was later followed by the railway. The chief barrier, however, is the unhealthy climate, which caused the disastrous failure of De Lesseps' attempt to cut a canal. In 1914 the Government of the United States completed the abandoned work at a cost of £100,000,000. The canal was cut from Colon on the Atlantic to Panama on the Pacific, a distance of about thirty miles. Like the Suez Canal, it runs for part of the distance through an artificial lake, and also it is a bottle-neck through which the ships of the world now pass. Unlike Suez, it is not a sea-level canal, but first rises and then descends by a series of locks or water steps.

The completion of the Panama Canal has been one of the most important political and economic events in the history of the Pacific. The chief effect has not been to bring Asia or Australia closer to Europe, but to bring the Pacific coast of both North and South America into closer touch with all North Atlantic regions and, in particular, with the Atlantic coast of North America. It has already had a very marked influence in stimulating the trade of California, and in forcing on the development of the Pacific side of South America.

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PART VIII

SOUTH AMERICA

CHAPTER XXXV

GENERAL SURVEY OF THE PACIFIC COAST

1. *Relief*

THE lofty western mountain system of South America is the longest and most continuous fold-line on the earth's surface. Running in an unbroken ridge from Trinidad to Tierra del Fuego, it wholly determines the character of the Pacific coast region. This, however, is a very general and also very inaccurate description of the great Andean system. More truly it may be said to take the form of a vast elongated plateau, nearly everywhere more than 10,000 feet above the level of the ocean and having an eastern and a western rim which rise another 8,000-12,000 feet above the floor of the plateau. In Bolivia and Southern Peru, where the plateau is highest, it also opens out to its greatest width, and behind the great inward bend of the coast-line to Arica it reaches a maximum width of about 200 miles. Occupying a depression in the floor of this plateau is the remarkable Lake Titicaca, a long sheet of fresh water over 10,000 feet above sea-level. The Pacific rim of this plateau has been associated with strong volcanic activity which has piled up lofty cones throughout its whole length. 'Tronador and Aconcagua, El Misti in Peru, and Chimborazo and Cotopaxi in Ecuador are simply outstanding examples of the hundreds of volcanoes, active, quiescent or extinct, that overlook the Pacific from the heights of the Western Andes.' South of the Bolivian plateau the cordillera falls away; but, with distance from the equator, the glacial action of the past becomes more marked,

and the mountain wall is broken in several places by transverse valleys.

Every aspect of South America on its Pacific side must be studied with reference to the general control exercised by the Andean system. The chief feature from the human and

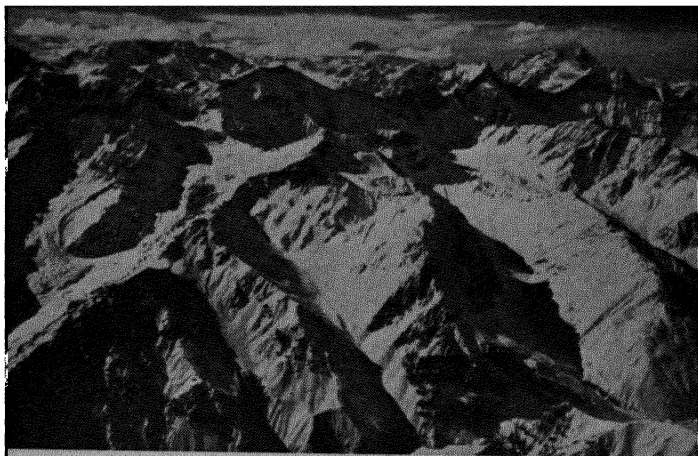


FIG. 173. THE ANDES

Like surf of a mighty sea, the Andes rear in giant waves.
The Andes near Aconcagua, taken at an altitude of 20,000 feet.

economic side, however, is not so much the height of land known as the Western Cordillera which runs parallel to the coast and about 100 miles inland, but the coastal range which develops in southern Peru, fronts the ocean steeply for 1,500 miles along the coast of Chile, and becomes submerged and detached as the ragged chain of islands farther south. As a consequence of this arrangement of parallel folds, coastal plains are either very narrow or entirely absent along the Pacific slope.



FIG. 174. The States of South America.

The moister conditions associated with the plateau, or rather with the Eastern and Western Cordillera rims, have developed erosion on the plateau more than on the Pacific slope. The floor of the plateau of Bolivia and southern Peru, in particular, is occupied by great quantities of alluvial material washed down from the cordilleras; and this alluvial soil forms the basis of the great upland pastures and of the cultivation which irrigation makes possible there. Loess formations similar to those of north China are also common. The Western Cordillera descends so sharply to the Pacific in the northern half of the continent, and climatic conditions are so arid over such a great part of its western slope, that the coastal rivers are merely seasonal streams; and more often lie in ravines carved in barren hill-sides than in valleys. In strong contrast, the foot-hills on the landward side of the Eastern Cordillera, known as the *Yungas*, are the forested upper slopes of the great eastward flowing rivers. To the north, in western Colombia and Venezuela, the whole system flattens out and breaks off into divergent chains.

2. *Climate*

The climatic regions of South America are mainly determined by the relation of the Andean highlands to the great wind systems. Every variety of climate is to be found in the mountain area, or on the lower levels of the plateau or coastal valleys, and often the change from equatorial to arctic climate is possible within a hundred miles owing to differences in elevation. Nevertheless, a broad classification into regions is comparatively easy. For that part of the continent east of the Andes and to the north of the equator, the north-east trades bring rain in summer; but winter is a season of drought since the prevailing winds, the south-east trades, have crossed the Guiana Highlands. On the Pacific

coastal strip, however, owing to the deflection of both the south-east and the north-east trades on-shore, rain is received throughout the year. Thus the lower slopes are densely forested with tropical types, while plants and trees of

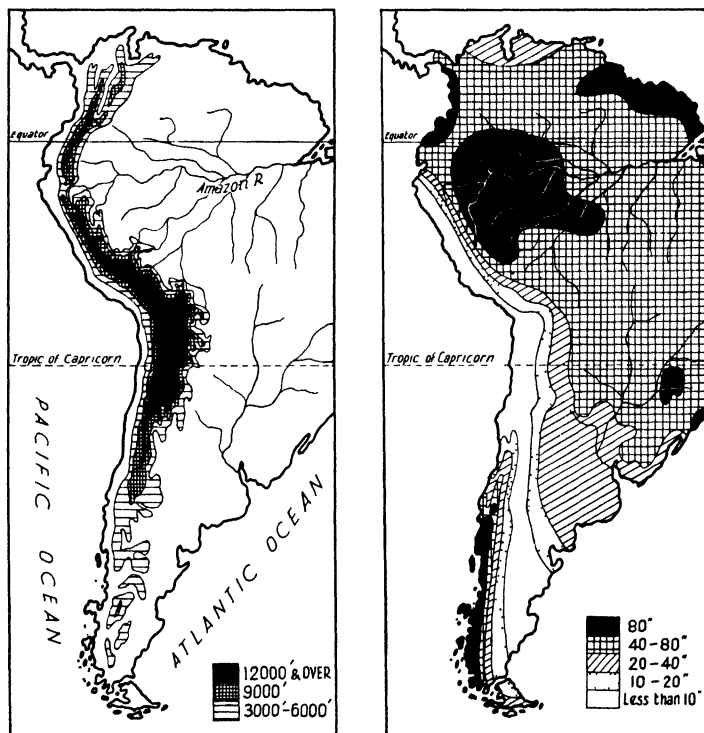


FIG. 175. South America—Topography and Mean Annual Rainfall.

temperate climate habit are found at higher levels; the slopes and valleys are used largely for the growing of cacao, bananas, and similar tropical crops.

The Pacific coast region south of about 5 degrees to about

30 degrees varies from arid to semi-arid. This is the result of the trade-wind circulation; coming from the east, these air currents lose their moisture on the Atlantic side of the continent, and the western coast, which is here the lee side, tends to be dry. This is intensified by the action of the cold Humboldt Current which runs north along this coast. On-shore winds are cooled as they pass over this cold ocean surface, and when they reach land and become warmed they tend to absorb surface moisture. These two factors explain the north-south extension of the arid region which reaches its climax in the desert of Atacama.

In the broad plateau area of Bolivia and southern Peru the climatic regions form a pattern of parallel strips, running north and south. These may be broadly sketched as: (i) The eastern slopes, warm to hot with rainfall up to 40 inches per annum but somewhat unreliable. Where the rainfall has been supplemented by irrigation, agriculture is carried on. (ii) The cordillera region, a bare sub-arctic area which is only populated where the great mineral wealth is sufficiently accessible to make the hardships worth while. (iii) The plateau proper, characterized by clear, cold weather with little rainfall. Here agriculture depends upon irrigation, but only hardy temperate plants such as the potato and barley can be grown. There is never sufficient heat to ripen crops such as maize or wheat. The chief occupations are therefore pastoral, and the natives rear sheep and the typical animals of the region, the llama and the alpaca. (iv) The Pacific slope, warm and dry, with possibilities for valley agriculture under irrigation.

After an intermediate region in the latitude of the Atacama Desert, the direction of the wind control is reversed; and farther south the mountainous west coast is opposed to the Westerlies. This produces along the coast of north

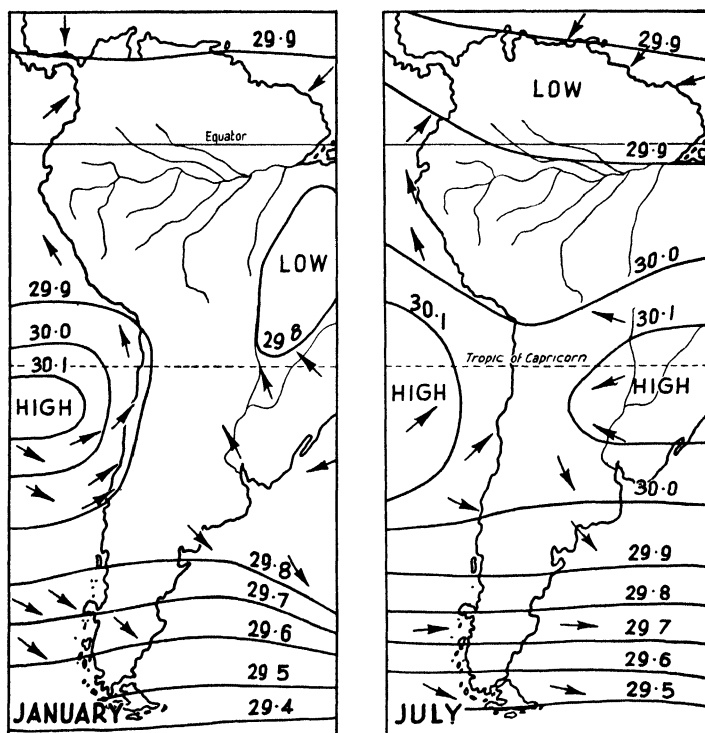


FIG. 176. South America—Pressure and Winds, January and July.

Chile the true Mediterranean winter-rain conditions, and for south Chile the abundant rainfall which produces temperate forest, but is excessive for agriculture in this latitude. The dry-belt is now found on the eastern side, and the conditions are strictly comparable to those in Tasmania and the South Island of New Zealand. The upper levels here form a great glacial field which merges, lower down, into swampy valley or water-logged plateau, and the region is practically uninhabited. Even on the drier east side

conditions of life are very difficult, and only in the warmer situations does pasturing of sheep become possible.

3. *People and Industries*

South America has not proved an easy country for development. As barriers to settlement, the tropical climate and luxuriant vegetation of the eastern lowlands are equalled by the lofty and inaccessible mountain plateaux of the west, and by the desert which, in great part, separates them from the sea. Nor has the development of the country been assisted by the presence of numerous and vigorous native peoples. The Indians of South America, a people racially allied to the Reds of the northern continent, are, in contrast, a primitive and spiritless people, composing three-quarters of the population of the Pacific regions of South America. They belong to two main branches, viz. the backward Aymaras (pron. Eye-mah-ras) and the livelier Quechuas (Kesh-wahs) of the lower levels. Accustomed to servile obedience from the days of the Incas, the Emperors of Old Peru, their experiences under Spanish rule, and later under that of the republics, have done nothing to advance the status or welfare of these folk. 'The Aymaras' existence,' says a writer, 'has been a continuous struggle against the environment of the bleak and inhospitable plateau, against hunger, cold, and the lack of oxygen,' and (he might have added) against inept governments. Living in an unfurnished stone- or mud-hut, wearing the poorest of woollen clothing and crude sandals when he is not barefoot, and existing on a diet of potatoes or rough barley bread, he is the labourer of the High Plains, the porter of the small towns and villages, and the drover of the mules or alpacas on the pack-routes between the mines and villages, living almost the life of the animals in his charge. The Quechuas are the most numerous element in the country

by far. They are the agricultural labourers, the miners, the serfs or *peons* of the ranches and plantations, sold with the land, esteemed very little higher than the stock they tend, and owning almost no political or social privileges. In the Andean zone proper there are probably some ten millions of Indians, who form a body of serfs incapable of owning land, without ambition, and restless to the point of becoming a danger to established government at any time. In addition to the Indians there is a very large half-caste element of mixed Spanish and Indian blood, known as *mestizos*. These are, in general, more intelligent and progressive, if more mercurial and unreliable. The land-owning and governing class is composed of the descendants of the Spaniards who came to these lands after 1500 in search of gold. The man of this class is sometimes a progressive pastoralist or careful farmer, but is more often an absentee landlord favouring the tradition of the grandee living in the towns on the income from his estates. There is a considerable difference, however, between the active and intelligent desire for progress in Chile and southern Peru, and the chaotic and often anarchic conditions in some of the other republics. The *mestizo* is the chief hope of the future since he combines intelligence to appreciate new methods with a physique adapted to the rigours of the climate in the highlands.

Unstable government is the chief curse and greatest barrier to progress in all the Pacific republics with the exception of Chile. But the extension of railways, and the control exercised through foreign capital invested in mines, railways, and plantations, might in time have a steadying influence. For any advance in methods of production, too great a proportion of the population has still to be used as mere carriers, owing to the nature of the country and the difficult mountain routes. This had an isolating effect that made

Bolivia, in particular, almost the Tibet of South America; and parts of Peru were very little better; and this condition will only disappear with the provision of roads and railways, and the development of air services.

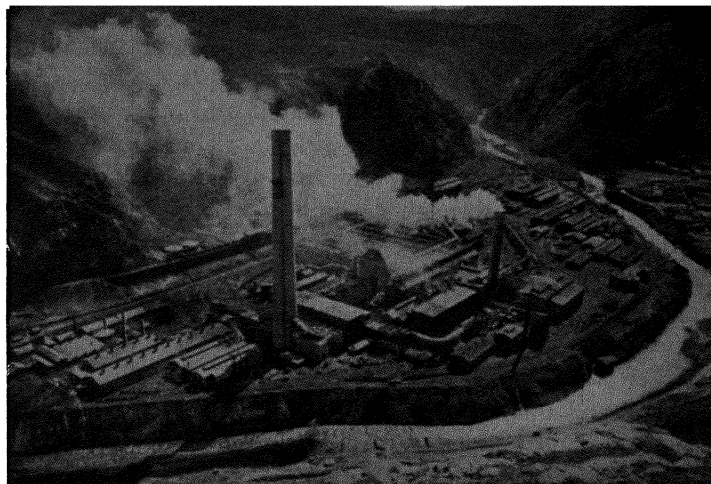


FIG. 177. Smelters: typical of the cordillera from Mexico to Peru.

4. *Minerals*

The wealth and extent of the mineral deposits were the real cause of the Spanish invasion of South America. The vast quantities of gold and silver exported since the Spanish occupation have not resulted in any benefit to the countries producing them, but have rather tended to keep the plateau regions in a state bordering on savagery. Modern mining development has given more attention to the deposits of minerals other than those of gold and silver; and the need for labour has forced attention to the condition of the labourers.

The chief difficulties in these days are connected with smelting of the ore and transport to the coast. Vast amounts of copper, tin and mercury had been taken from the plateau regions even before the advent of the railway; but the import of capital, the extension of railways, and the development of the ore-bodies by large-scale methods is having an enormous effect from one end of the Andes to the other. Gold-mining is now comparatively unimportant; and silver is important only through its association with other minerals, in Peru with copper, in Bolivia with tin. The chief production for the whole region is now that of copper from a rich zone running right through the Bolivia-Peru plateau. Large smelting works in central positions now draw the ore supplies from the mines by rail; in fact the railway is the key to mining, as it is to farming development, throughout the continent.

Other rich zones occur in Bolivia where tin, silver, bismuth, and tungsten are mined. The Andes are also the world's leading source of vanadium, and second only to China in the production of antimony. For some time, the river gravels in western Colombia were the leading source of platinum but exports are now dwindling. It is estimated that Chile alone has enough sulphur in the craters of the mountain section, and borax in the *salars* or salt-flats, to supply the world with those commodities for centuries to come. The mineral areas are chiefly in four sections: (i) the region served by the Central Railway in Peru; (ii) the Eastern Cordillera in Bolivia; (iii) the Cauca Valley and the adjacent Pacific slope in Colombia; and (iv) the Andean area of northern Chile. Dr. E. W. Shanahan has said:

'In no comparable region in the world have such quantities and such a variety of igneous rocks been forced through the crustal formations at such numberless points both in the flanks of the ranges

and at their summits; nowhere else have the minerals brought up to the surface been so well preserved from the action of denuding forces as in the Central Andes; but in no other highly mineralized region do most of the ores lie at such high altitudes or in such bare and wild mountain country as they do from Ecuador to southern Chile. Even within the tropics many of the richer deposits are situated quite near the snow line, sometimes, as in Bolivia, on rugged spurs between the glaciers.'

CHAPTER XXXVI

COLOMBIA AND ECUADOR

1. *Structure and Relief*

TO the north and south of the mountain knot in southern Colombia the character of the Andes is very different. On the north they fall away to the Pacific or to the Atlantic in a series of diverging ranges; to the south they assume the broad plateau formation of Peru and Bolivia. The Western Cordillera is broken by comparatively low passes in Colombia; but in Ecuador it offers such a barrier to transport from the Pacific that the railway from Guayaquil has to climb nearly 11,000 feet to reach the plateau. In Colombia two great ranges swing away from the Pacific towards the north-east, and of one the West Indies are a partly-submerged extension. Valleys thus open out which allow the incoming ocean influences access far into the interior, a great contrast to the conditions farther south. The Central American chain, which forms the Panama bridge, is a low range, structurally quite distinct from the Andes.

The mountain fold close to the Pacific, known as the Coastal Range, is here much higher than it is farther south; and diverts the streams to the northward. This arrangement

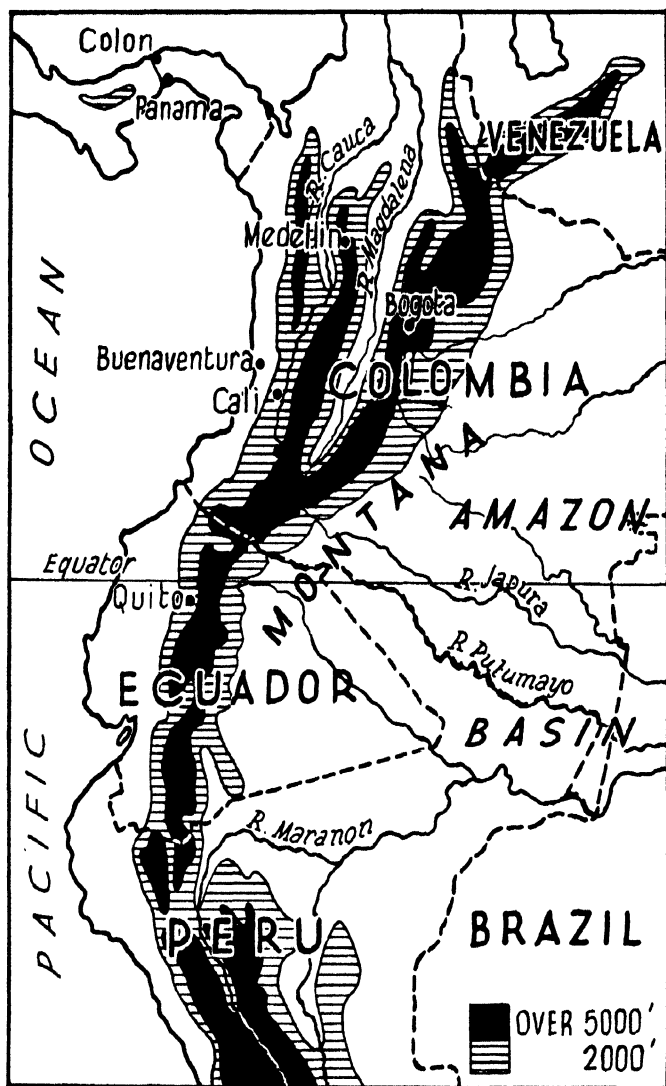


FIG. 178. Colombia and Ecuador.

of the highlands breaks the drainage into three systems, viz. the Pacific, Caribbean, and Atlantic rivers. On the western slope the Daule, S. Juan, and Atrato rivers have eroded considerable valleys before breaking through the Coastal Range to the sea. In contrast to the raised coasts of Peru and Chile, the Pacific coast of Colombia and Ecuador has sunk and drowned the lower valleys of these rivers, forming the only estuaries on the western side of the continent.

To the west and north of the maritime ranges lies a distinct region, the coastal lowlands, varying from a mere strip 15-30 miles wide, to the much more extensive swamps around the estuaries where mangroves predominate. Farther back, the slopes and upper valleys comprise the main agricultural areas. This well watered but empty coastal district offers a striking contrast to the arid Peruvian coast, where every foot of irrigable land has been occupied.

On the other side of the plateau are the foot-hills dropping away to the upper basin of the Amazon, and drained by many large tributary streams. This region, known as the *montana*, has every circumstance of elevation and climate in its favour; but its great distance from the Atlantic has maintained a condition of undeveloped isolation even more marked than that upon the enclosed tablelands of the Andes. The *montana* of Peru and Bolivia is comparatively easy of access along the main and tributary streams of the Amazon; but the rapids along the rivers keep it isolated. The interior of the north-western section of the continent is, in fact, faced by a rather tragic dilemma. Transport must take either the shorter but very difficult route through the Andes to the Pacific, or the longer way across the swampy lowlands to the Atlantic. Further, many of the longer rivers, which would offer the natural route, are broken by gorges and rapids to such an extent that the people in the upper valleys turn to the

Pacific of necessity in all matters of transport and trade. Economically these become Pacific regions. The upper Cauca valley of Colombia, in particular, is accessible from the Pacific port of Bonaventura through a comparatively low pass 5,000 feet above the sea, which therefore becomes the outlet for a rich agricultural and mining region on the opposite side of the ranges. The new pan-American highway, built to foster trade and social intercourse between the North and South American continents, and the development of airways will prove of the utmost importance in linking the countries facing the Pacific in South America with their northern and southern neighbours.

2. Climate and Vegetation

Almost the whole of the northern coast of the continent is a summer-rainfall region, rather monsoonal in character. But the arrangement of the mountains, and the continuous indraught from the ocean to the land caused by the presence of such a great land-mass so near the equator affects the rainfall; and, in consequence, the winter drought is not clearly marked. This applies to the Pacific coastal area particularly. The average temperature over the coastal lowlands is high, averaging 75°-85° for the year. This rain and heat brings the forest belt right down to the shore-line. Such a climate is most unhealthy for Europeans, and the dense jungle growth is a serious barrier to the development of the country. It is not surprising, therefore, that settlement is confined to the higher levels where rainfall is less, the forest thinner, and the land better drained than it is nearer the coast.

The luxuriant growth of the tropical forest is, however, confined roughly to the coastal areas and to the lower valleys and slopes. At levels exceeding 5,000 feet this changes to

the type of forest usual in temperate climates; and it is everywhere less dense than in the lowlands. The plateau areas at 8,000-1,000 feet are grasslands with very little tree growth. The whole Pacific slope in Colombia and Ecuador, it should be noted, is a forest region and distinct in every particular from the slope farther south.

3. *Production*

'Such conquest of these tropical shore-lands as has been effected by man,' writes Dr. Shanahan, 'has been at great cost of life, and has been singularly incomplete.' Conquest of tropical conditions has not been carried to the lengths attained in Malaya or West Africa; and the reason is not far to seek. Almost everywhere, in lowlands and uplands, the forest makes settlement dependent upon great effort. But life is easy where foods like the banana, the coco-nut, and mandioca are so abundant; and in such a climate it is difficult for white and coloured people to be energetic.

But the tropical lowlands of South America on the Pacific slope have shared in the greater attention that the world has been paying in recent years to its equatorial regions. The exploitation of the rich mineral deposits, which were the main attraction of the interior for Europeans, made some survey of the coastal area a necessity; and so a desultory sort of settlement followed. Later, Europe's need of sugar forced on the cultivation of some districts; but that is about the full extent of settlement at the present time. World shortages of foodstuffs tended to hasten development after the war.

The inland slopes, facing the incoming rain-bearing winds, have a better record. Here are found the best conditions for many kinds of tropical agriculture, and the climate is

more tolerable for both whites and Indians. In particular, it is ideal for the cultivation of cacao. This plant, because of its heavy pods, must be sheltered from strong winds; and it also needs abundant rain, uniformly high temperature, and fertile soil. It also requires shade, and this is obtained by growing it alternately with bananas. Ecuador and Colombia contain the largest area of land offering such conditions; but since the cultivation and preparation of cacao demand such an amount of careful labour the premiership in this industry has passed to West Africa. The 'go-as-you-please' attitude of parts of South America is in fact responsible for the loss of one industry after another. Production of all kinds from rubber to sugar, and from cinchona to nitrates, is passing more and more to areas not so well fitted by nature.

With coffee, produced at 3,000-6,000 feet, there has been more insistence on maintaining quality, and this product has succeeded in retaining its hold on the world's markets. Some cotton is grown in Colombia and recently more attention has been paid to it in Ecuador. Mandioca, the staple food of the people, is produced from *cassava*, a root native to the region. From it a flour, *farina*, and the tapioca of commerce are prepared. Conditions for rice are ideal in the lowlands, but little is grown. Coco-nuts and bananas grow wild in great profusion; but the production of copra is unimportant since the West Indies are much nearer the fruit markets of Europe. Forest wealth is considerable, but scarcely touched as yet. Tagua-nuts, the source of vegetable ivory; mangrove bark and other tanning materials, rubber, chicle (the gum of the zapote-tree, the chief constituent of chewing-gum), mahogany, and other timbers are all natural products. In the eastern foot-hills coca leaves and cinchona bark are valuable products yielding cocaine and quinine, two most important drugs. But the production of rubber and cinchona

is declining in value owing to the production on the great plantations on the other side of the Pacific. For years, perhaps, this great area must be regarded as a reserve for future development; at least till the more developed lands of Africa and Indonesia begin to fall short of world demand.

People

Columbia and Ecuador contain about 12 million people and the greatest concentration occurs in the plateau and the coastal regions. The plateau is everywhere an important stock-raising and agricultural region; but, owing to its isolation, a certain independence of the outside world is noticeable. Mining, especially for gold, was formerly a valuable industry, but is now declining. The coastal population is chiefly engaged in tropical agriculture or trade, and an oil-field is worked in Ecuador. Some ports, such as Guayaquil, serve a hinterland in Ecuador reaching right back to the plateau or even to the montana. Others are the outlets for a very limited stretch of coast-land. *Bonaventura* (15,000) is the only Pacific port on the Colombian coast. The plateau towns, such as *Quito* (150,000) in Ecuador, *Bogota* (350,000) and *Medellin* (145,000) in Colombia, occur in a long line at elevations of about 10,000 feet, and are supported by the pastoral and agricultural industries of the area.

The Galapagos Islands, a dependency of Ecuador near the Equator deserve a note. The group is volcanic in origin and so arid that it might be regarded as a desert archipelago consisting of twelve large and several smaller islands. The name is Spanish for tortoise and was given for the extraordinary number of turtles, large and small species, with which formerly abounded around the coasts. There are peculiar features on both the fauna and flora of the group.

CHAPTER XXXVII

PERU AND BOLIVIA

1. *Peru*

PERU'S half million square miles stretch from the Pacific to the valley of the Amazon and hold 9 million people. There are thus three contrasted climatic regions within its boundaries, viz.: (i) the semi-desert belt along the Pacific front, 1,400 miles in length and 50 miles wide, with the irrigated valleys of the short coastal rivers situated like oases along the barren slope; (ii) the plateau proper, which has already been described; and (iii) the forested slopes of the Amazon Basin which make up half the surface area of the country. Peru, with the exception of this third area, is practically a rainless region, lying as it does in the lee of the cordillera, sheltered from the rain-bearing winds from the Atlantic. Only by irrigation, made possible by the melting snows on the cordillera, can agriculture be carried on even in the valleys.

Peru has a peculiar and melancholy interest because of the ruthless destruction of the old Inca civilization found here by the Spanish adventurers in the sixteenth century. The ruins of the great stone buildings and causeways are a majestic reminder of the level reached by these people in the arts, as the irrigation channels and terraced mountain sides are still a tribute to their skill in agriculture. Of the present population of seven million, over half are whites (Spanish) or *mestizos*. Nearly three million Indians, 42,000 Asiatics and 29,000 negroes, descendants of slaves imported in past times, complete the population picture. The Europeans, other than Spanish born in the country, live mostly in the ports, where they are engaged in trade or the administration of mines or plantations.

The productions of the country consist chiefly of the plantation crops of the irrigated coastal areas, the petroleum of the same area, the minerals and wool of the plateau, and the timber and sub-tropical products of the montana around the headwaters of the Amazon. The cultivated valleys are a mere 1,000 square miles in extent; but they, nevertheless, produce 60 per cent. of the country's agricultural output. Irrigation is the chief concern of the Government; and such schemes as that involved in taking a river through the cordillera by a tunnel 18 miles in length to irrigate a further 500 square miles of territory sufficiently illustrate the difficulties of the country. Cotton, the chief crop, is grown in irrigated valleys along the coast. The native variety, which was a staple in the days of the Incas, is now consumed



FIG. 179. THE SEATS OF THE MIGHTY

High up in the Andes, there are many such "thrones" carved out of stone by Inca Emperors.

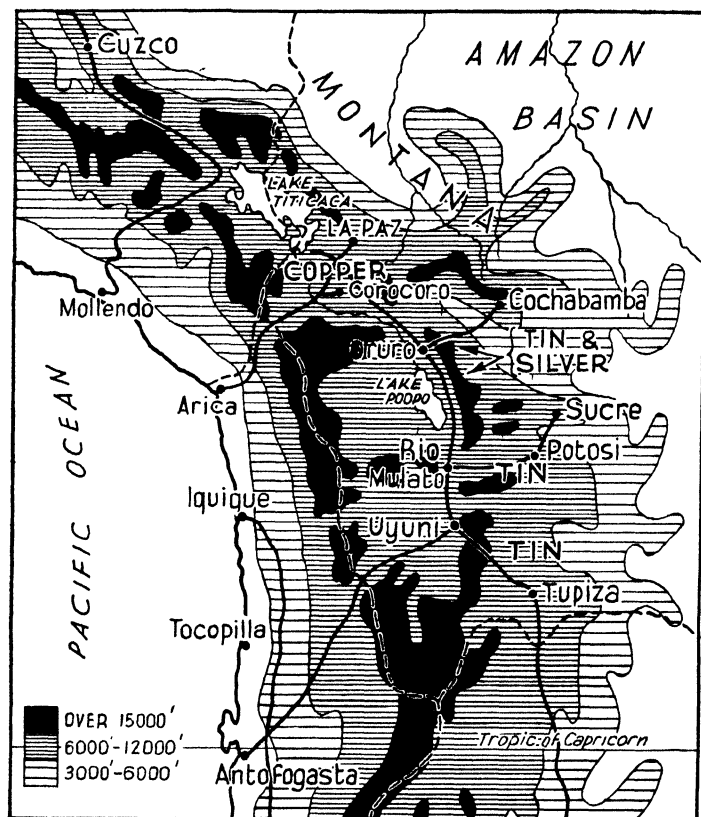


FIG. 180. Mining regions, Peru and Bolivia.

locally, while the Egyptian variety is produced for export. Sugar, also grown in irrigated valleys around Trujillo in the north, is the second crop. Apart from sugar and cotton, such crops as rice, Mediterranean fruits, bananas and cassava are produced. On the higher levels of the plateau most temperate fruits and grains are grown to some extent.

Peru yields also a wide range of most important products such as petroleum, copper, silver, gold, vanadium, and guano, and about enough coal for the railway and smelting needs of the country. Since the decline in gold and silver production, copper ranks first among the metals. Venezuela and Colombia both produce more petroleum than Peru, but its output is quite important, totalling about 2,000 tons. About half the world's supply of vanadium, a metal used as an alloy in producing steel of light weight and great strength, used particularly for motor vehicles, comes from Peru.

The cold Humboldt Current, which is so largely responsible for the arid condition of the western slopes, compensates to some extent by bringing northward a great wealth of sea-life, which in turn attracts vast numbers of sea-birds. These birds, over long ages, have built up the great guano deposits which are now so important an element in fertilizers for the farming countries of the world. The long-standing dispute between Chile and Peru concerning the possession of the northern nitrate area was settled by a treaty which gave Tacna to Chile in return for £1,200,000.

Peru has no less than twelve towns of over 20,000 people. The most important of these are: (i) *Lima, Callao, Trujillo*, and *Piura* in the coastal belt; and (ii) *Cuzco, Sicuani, Arequipa*, and *Cerro de Pasco* on the plateau. *Lima* (535,000), an old city in the Spanish style, is both capital and commercial metropolis. It has many factories and handles most of the business of the country. *Callao* (85,000) eight miles to the west of Lima, has the best harbour on the Peruvian coast, and conducts 50 per cent. of the country's trade. A factor in its importance is the railway to the great copper-producing area of Cerro de Pasco. *Mollendo*, the second port, is the terminus of the important route via Lake Titicaca. Transport over the

whole region is tremendously difficult and still depends largely upon trains of mules and llamas; and this adds to the importance of the sea routes and terminal ports.

2. *Bolivia*

Since the drainage of landlocked Bolivia is to the centre of the plateau or eastward to the Amazon Valley, it is not

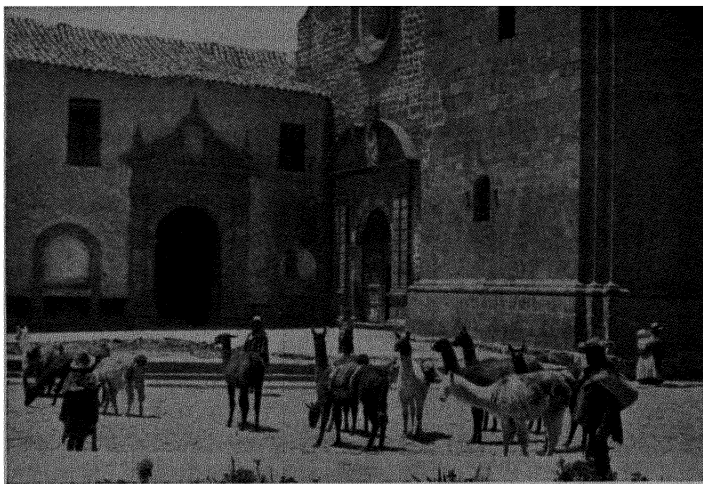


FIG. 181. This monastery at Cuzco (Peru) contains many stones cut in the time of the Incas. Notice the llamas in the foreground.

strictly a Pacific country. Its area of about 500,000 square miles falls into four main districts: (a) the high steppes or *antiplano* on the Pacific or west side; (b) the fertile valleys or *yungas* intersecting the plateau; (c) the rain-forests or *selvas* on the east falling away to the low-lying Amazon basin; and (d) the plains and salt basins (*salinas*) of the southern area. The difficult nature of the country in general, and especially of the cordilleras on the eastern and western

rims of the plateau, has produced an isolation that is broken only by the infrequent railway and the inadequate mule-train. The plateau produces insufficient food for the inhabitants; it is scourged by cold winds; it suffers a long and bitter winter that prevents the cultivation of all but the most hardy crops and makes forest growth impossible; and conditions generally are hostile to human progress.

The 3½ million people are mainly occupied in pasturing flocks of sheep, alpacas, and llamas, in the mixed agriculture of the valleys, or in mining. If petroleum is ultimately found in commercial quantities this may help the country's development, but always and everywhere the great barrier is the difficulty of transport. The 1,300 miles of railway in the country are mostly on the plateau, linked to the ports of Mollendo, Arica, and Antofagasta, through which 90 per cent of the trade moves.

The montana region has large areas of grassland which pasture considerable numbers of wild cattle. Maize, sugar, coffee, cotton, and tobacco are cultivated; and a curious industry is the gathering of coca leaves, the main use of which by the natives is for chewing as a narcotic. The mineral exports of Bolivia are, in order of value, tin, tungsten, antimony, lead, copper, and zinc. *La Paz* (200,000) lies in a sheltered position in a deep valley 1,500 feet below the floor of the plateau. It is the commercial metropolis, and a modern city with electric services of all kinds. Its chief importance comes from the neighbouring tin mines. *Oruro* (45,000) is the collecting centre for the tin and silver of the central area, and is on the main plateau railway. *Potosi* (40,000), once the greatest silver-producing area of all time, is now of declining importance. *Cochabamba* (100,000) is the second city and the centre of one of the best agricultural areas. *Sucre* (28,000), the legal capital, is also dependent on the surrounding agriculture and pasture.

CHAPTER XXXVIII

CHILE

1. *Structure and Relief*

IN more senses than one Chile is China's opposite number. In place of a compact block of country we have in Chile a long thin strip of territory that is remarkable for the differences it presents. Chile has been called a land of contrasts, and the label fits the country exactly. Its extreme length of nearly 3,000 miles, i.e. about the width of Australia, contrasts with its narrowness of less than 100 miles, or half the width of Tasmania. The hot, rainless desert in the north contrasts with the cold, rainy region of the south. Again, the mining of the north, which is the main occupation, contrasts with the farming of the central regions in a remarkable way.

The whole character of the country is determined by the broad belt of the Andes which sweeps down the whole length of the country, more as a definite range than as the series of broad plateaux it presents to the north, falling gradually in elevation to the extreme south. The mountain wall, too, is here more broken by passes, although for various reasons the east-west traffic is very small. Farther to the west of the main range the land finishes as a well defined rim known as the Coastal Range. This rim rises to heights of 7,000 feet, but to the south of Valdivia it dips to become a fringe of islands or a fretwork of fiords very similar to the formation found in the south-west corner of New Zealand. This Coastal Range, however, exercises an influence on the country out of all proportion to its height.

By far the most important feature of the country, at least from an economic point of view, is the long narrow depression lying between the Andes and the Coastal Range and known

as the Vale of Chile. This is a great terrace of alluvial material carried down from the Andes and held back by the coastal retaining-wall. This filling of sediments forms at once a great plain, more or less level, and a bed of fertile soils which is the basis of the country's agriculture. The coastal

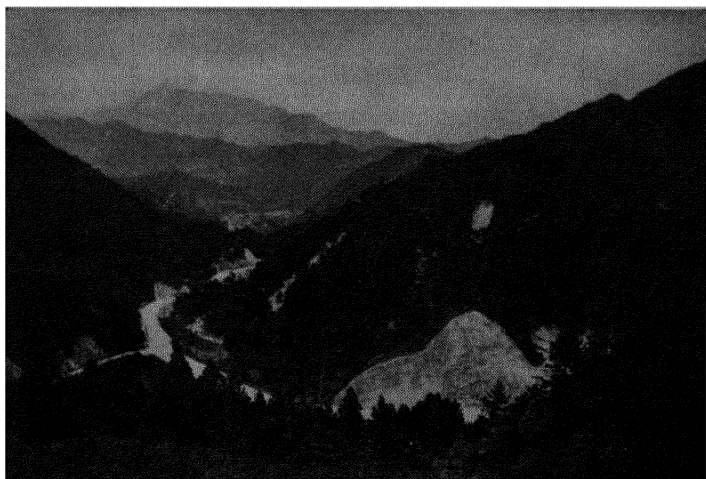


FIG. 182. GLACIER, CHILE

One of the many glaciers which wind their way downward from the peaks of the Andes.

rim has been gradually raised in the past, but the rivers have been able to cut down faster than the land rose and so they run in all cases across the Central Valley and break through the Coastal Range by gorges. Elevation, in fact, is still in progress; and the raised beaches of the coastline together with the frequency of earthquakes show what a young country this is in a geological sense. Earthquakes occur at the rate of two a day, but only about two a year have proved very destructive. The central valley is by no means a continuous depression.

Bisected into north and south sections by a hilly region north of Santiago, it loses for some distance the character of a valley altogether. In contrast to the Californian coast, harbours have not been formed where the seawall has been breached, because of the high level of the Vale of Chile. The southern section of the Vale contracts here and there to mere defiles between the Andes and the Coastal Range.

2. *Climate*

Climatic regions in Chile are very clearly marked. To the north is that area which comes under the influence of the prevailing high-pressures—the true trade-wind desert region, where rain falls very seldom and never in any quantity. Farther to the south this gives way to a zone affected during the cold months by the cyclonic influences of the west-wind region, and having a marked winter rainfall and summer drought. That part of the Vale of Chile coming under these weather conditions has become the ‘garden of Chile’ and is, indeed, very like California in many respects. All the typical Mediterranean plants are to be found growing in this area, most of them, of course, having been introduced. The natural vegetation is a series of beeches, laurels, and cypresses. Farther to the south the excessive rainfall, 100 inches and more during the year, results in a heavily-forested region where Chilean pine mainly predominates.

In central Chile, as in California and in the similar climatic regions of southern Australia, settlement has proceeded along the river valleys wherever irrigation can be practised. In southern Chile, on the other hand, as in south-west Tasmania and New Zealand, the excess of moisture has left the country largely uninhabited, although other factors in the situation are the prevailing low temperatures and the poor soils. Another curious contrast which should be noticed is that, although

the settlements in the irrigated valleys 'suffer from time to time through lack of water in their supporting streams, and through failure in their average scanty rainfall, their worst enemy is floods which either sweep away the inhabitants'



FIG. 183. A MODERN MOTOR ROAD

The Utah Highway to and through the Rockies is typical of others in Alaska and Central America and still later routes being constructed in South America.

crops and belongings, or still worse, strew their fields with thick layers of pebbles and debris brought down from the mountains above.' Seventy per cent. of the population of the country is supported on the three million acres of these irrigated lands in the Vale. The ranges boast very little plant life, although considerable flocks are pastured in the grassy uplands, as well as in the belt between the desert region and the irrigated areas.

3. *Occupations*

Following the climatic zoning of Chile, a similar pattern of industries dependent upon the land is to be expected. Mining, pasture, farming, and forestry succeed each other from north to south of the country in that order. Some variation to the regular succession is caused by the rise in level towards the Andes; and, in general, mining for metals is confined to the mountains as it is in Peru and Bolivia. Mining is the dominant industry of the country. Chile has the world's largest deposits of nitrates and iodine, and is the second source of supply for copper. Coal and iron are also mined, the latter being an important export.

Chile's chief export, nitrate, deserves a special note. Nitrate of soda, carried down for long ages in solution by the streams from the Andes, has, by evaporation in the dry desert climate, been deposited along the margins of the *salars* or salt-basins. In the great expansion of agriculture during the last century, and the need for feeding large industrial populations, the world found that these nitrate deposits were invaluable. Phosphorus, potassium, and nitrogen are the three great foods demanded by plant life. Continuous cultivation of the soil exhausts these constituents, which have to be replaced in the form of fertilizers. Consequently most farming countries are concerned about the supply especially of nitrates and phosphates. Further, since nitrogen is essential for the manufacture of explosives, in the event of war the source of supply would be separated from Europe by a hazardous sea voyage. A certain amount was produced as a by-product from the coking of coal, but this too was felt to be inadequate in times of war. Thus the chemists of the world set to work to discover a means whereby the free nitrogen in the air could be 'fixed' and used both for fertilizers and explosives. In this they succeeded and for the

last two decades the Chilean nitrate industry has been fighting a losing battle against competition from synthetic nitrates.

The cities of Chile reflect the variation of the country itself, situated as they are in regions which vary from hot desert in the north to cold glacier country in the extreme south, and from mining areas to agricultural and forest districts. *Santiago* (1,000,000), the capital and most important city, sits in the Central Valley about 90 miles from *Valparaíso* (250,000), the largest port on the Pacific coast of South America. Both settlements have played historic parts in Chilean history especially after the coming of the *conquistadores*. Francis Drake and Hawkins took possession of Valparaíso in 1578 and 1598, respectively. *Antofagasta* (52,000) is the port for the northern mineral district, and *Arica* is the most northerly port and connects by rail with *La Paz* in Bolivia. *Talca* (50,000) is chief centre of the central wine district, exporting through *Constitucion*. *Temuco* (45,000) is an important rail centre; and *Valdivia* (40,000) is a thriving port. Further south on the Magellan Strait and in a forest-fiord area still little known lies *Punta Arcas* (30,000).

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